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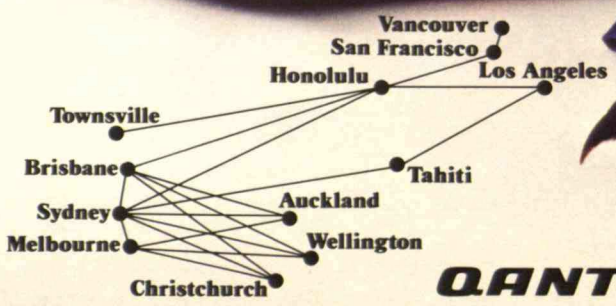


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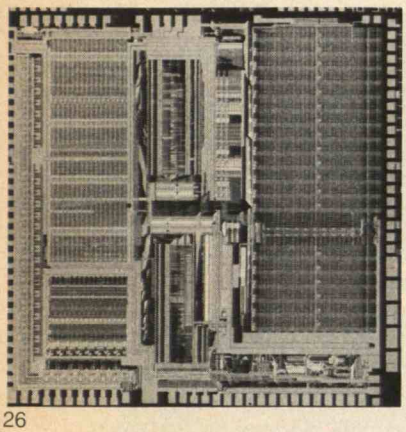
# Technology Review



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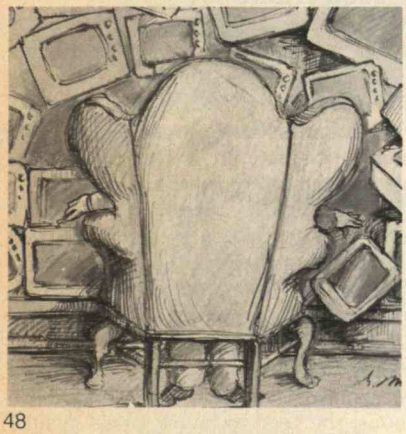

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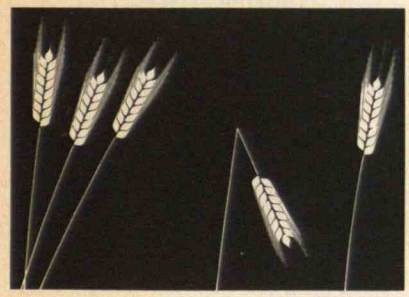

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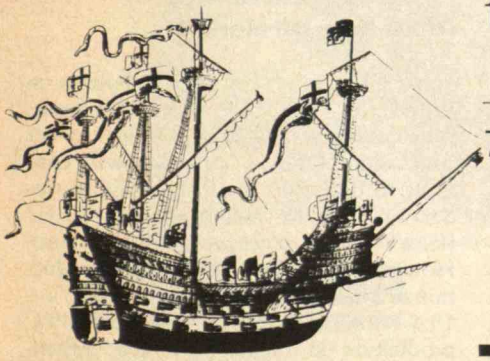

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# LETTERS

## New Lamps for Old

Samuel Florman's "Firming Up Foundations for the Future" (*October, page 11*) leaves the impression that solving the problem of crumbling foundations is simple: just stop spending money on grandiose future developments and go to work on all the overdue maintenance. Tell our legislators to authorize the necessary funds and presto, we'll fix everything up. However obvious this solution to the growing disaster of deferred maintenance, it is politically unattainable.
William B. Elmer
Andover, Mass.

How true it is that in our fantasies about the technological future, we forget to "housekeep" that which technology has already provided. I am reminded of my children, who would always rather have a new toy or new pair of jeans than see the old ones repaired. For all the maturity that advanced knowledge brings, we seem stuck with that childhood lament, "But, Mom, I want a *new* one!"
Charlene Russell
Kalamazoo, Mich.

## Comparing Soviet and American Weapons

There are fundamental differences in design, philosophy, and weapons-procurement practices between the Soviet Union and the United States. However, comparisons should not be based simply on program continuity, numbers, and technological direction, as William Perry and Cynthia Roberts suggest in "Winning Through Sophistication: How to Meet the Soviet Military Threat" (*July, page 26*).

The authors assert that the Soviets achieve a numerical advantage in military forces not by building simple, cheap equipment but by spending twice as much as the United States. However, much of the Soviets' equipment is considerably simpler than its Western equivalent. For example, Soviet jet engines have fewer moving parts than similar engines designed in the West. Another difference is that the Soviets' military R&D and procurement costs are lower than their maintenance costs. This proportion is likely to be the other way around in the United States. And the Soviet economy is not a fiscal economy: it is a resource-allocation economy. There is no adequate way to evaluate either the "cost" or the value of labor in such a setting.

Analysts need a more sophisticated method of comparing the two countries' military investment. The authors fail to acknowledge this difficulty, which has fueled a long debate over the methodology and figures used to make such comparisons.
Thomas H. Etzold
Newport, R.I.

*The writer is director of Strategic Research in the Center for Naval Warfare Studies of the Department of the Navy.*

## Antisocial Contract

In "The Role of Government in a Free Society" (*August/September, page 6*), Kenneth Boulding overlooks one fact: by accepting his basic premise—that the government's role in a free society includes the right to regulate and control the lives of individual citizens—one is committed to a society in which individual freedom ceases to be an inalienable right. Instead, an individual remains free only by the grace of government. Such freedom, by its very nature, can easily be revoked by the government whenever it is deemed necessary or desirable. With freedom so tenuous, the need to be on guard against the activities of the government becomes extremely great.

Yet Professor Boulding suggests that we be less antagonistic toward the entity that has total power over our lives. Perhaps he hopes that the responsibility of true freedom based on individual rights will be frightening enough to keep us from rebelling against the illusory freedom he advocates.
Steven P. Nespolo
Woonsocket, R.I.

## OPEC-Free Oil Market

Nazli Choucri's "Power and Politics in World Oil" (*October, page 24*) omits statistics suggesting that contrary to her conclusion, OPEC's influence will continue to diminish. In 1981, OPEC's production was 18 million barrels a day (MBD) despite a capacity of 31 MBD. However, the West's non-OPEC production was slightly greater than OPEC's—19.5 MBD. At current prices, non-OPEC production in Mexico, Canada, Argentina, West Africa, China, and Southwest

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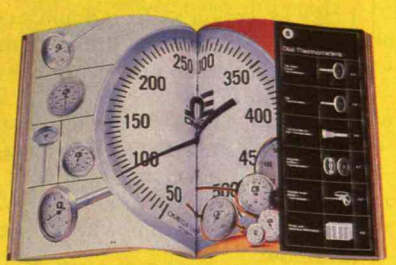

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Asia will continue to increase as these countries develop their vast resources, producing 5 to 7 MBD by 1990. These new resources are likely to increase competition in the international oil market.

Some OPEC countries with unused capacity, notably Nigeria, Iran, and Iraq, may add to the glut in the next few years. For example, if Iran and Iraq resolve their dispute, an additional 2 to 3 MBD would be available for sale within a year.

Thus, OPEC can remain dominant only if the Persian Gulf countries reduce their prices substantially. And since they are not likely to do so, an independent international market will continue to evolve while oil prices fluctuate just like any ordinary commodity.

Lawrence A. Goldmuntz
Washington, D.C.

### Algebraic Fantasies

I take exception to Joan Baum's criticism that John Saxon uses other than "relevant" examples in his algebra word problems (*"Math for the Masses," August/September, page 84*). As a former teacher, I remember students working lethargically on problems in which a boat went up and down a river but enthusiastically where an asbestos lizard swam with or against a lava flow.

Stan Hartzler
Oklahoma City, Okla.

### Wrong Vertical Key

If we assume that Martin Anderson correctly stated that 8 million automobiles are produced each year in the United States (*"Shake-Up in Detroit: New Technology, New Problems," August/September, page 56*), then the graph on the following page is incorrect. The vertical key should range from 0 to 12 million vehicles and not 0 to 1.2 million vehicles.

Emil Wisekal
The Woodlands, Tex.

### Correction

A computer model of an antibody molecule, shown on page 23 of the October issue, was incorrectly credited. The model was generated by Dr. David R. Davies and colleagues at the National Institutes of Health.

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ROBERT COWEN

# Sputnik Splash, Space-Age Fizzle

It was Friday, October 4, 1957. A fire crackling on my hearth illuminated books laid out for review. They foretold a someday world in which machines would travel into "outer space"—beyond the atmosphere and among the planets. But the telephone interrupted my reading. It was the editor of this magazine calling to say that a Russian-made "moon" (*Sputnik* 1) was cutting the sky, and that M.I.T.'s computation center was preparing to calculate the orbit as data came in from the Smithsonian Astrophysical Observatory up the street. The editor and I rushed to what was then the only such center outside the Soviet Union prepared to do this.

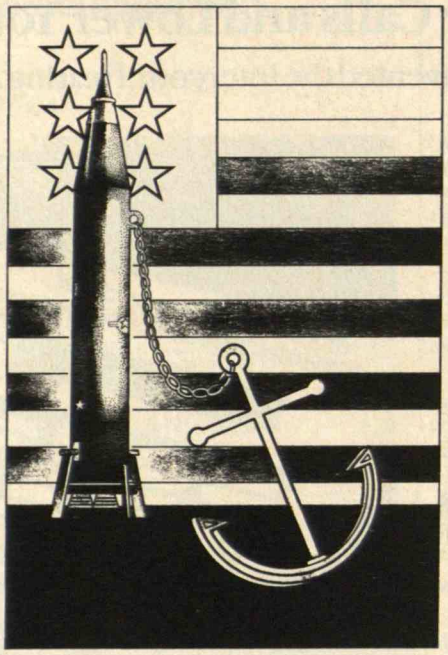
Fire and books were forgotten—reality had made the prophesies obsolete. Our familiar world of vast continents and trackless seas had become for practical purposes what the books said it was in theory—a fairly small planet, isolated in space, soon to be girdled by its civilization's machines and linked by them to the moon and the planets. From now on, "outer space" would be our neighborhood.

Twenty-five years later the United States has yet to face that challenge fully. For the U.S., this has been an enduring theme of the space age along with, and in spite of, the stunning success of its lunar exploration, the unfolding promise of the reusable space shuttle, the omniscience of its reconnaissance satellites, and the growing profits from its orbiting communications network.

### A Flickering Hope

Sputnik caught the country off guard. Fifteen years later, on the occasion of another Sputnik retrospective, James C. Fletcher, then administrator of the National Aeronautics and Space Administration (NASA), warned that the United States had dissipated much of the industrial base for space operations that had been built up for the Apollo-Saturn program. He pinned his hope on the prospective shuttle program to sustain the competence that remained. He said he believed

ROBERT C. COWEN is science editor of the *Christian Science Monitor* and former president of the National Association of Science Writers.



that without the shuttle, the United States would enter the 1980s with no real route to the space future.

At that time, he and many others lamented the country's lack of a clear vision of what it could and should do in space. But, given the shuttle, the country would at least keep some options open. While policymakers now debate how best to use the shuttle, they have cut the projected number of missions from 500 to under 300 over the next 10 years. And the country's magnificent planetary and space-science effort withers.

Again, authoritative voices sound ominous warnings. For example, the congressional Office of Technology Assessment (OTA) says the United States must commit more of its public and private resources to the space effort or lose its leadership in space applications to Japan, Western Europe, and the Soviet Union. OTA has followed up with a technical memorandum to Congress noting that many scientists think the U.S. space-science program is in a state of crisis. Among other indications, the OTA points out that several major missions, such as a radar mapping of Venus, have been indefinitely postponed while funding for important interim activities, such as data analysis from previous missions, is inadequate. It also observes that international cooperation in such projects has been both fruitful and a good way to share costs. But the OTA notes that potential foreign partners are now reluctant to enter into future agreements with the United States because the latter has already reneged on some of its commitments.

### Angel in Disguise

There is a great deal of deja vu in all this, so a look back at 1957 can be instructive. Both the Eisenhower administration and the American press and public greeted the reality of Sputnik with a mixed sense of awe and alarm. The scientific and technical capacity of the country seemed challenged. There was a general, ill-founded sense of inadequacy, but the event had been plainly foretold.

To begin with, both countries were planning to launch satellites as part of the program of the International Geophysical Year. Also, while the Soviets did not announce the launching of Sputnik until the "bird" was successfully in orbit, they made no secret of their general intentions. Soviet space scientists were sometimes quite candid with Western colleagues. One such scientist told friends to expect an October launch when he visited Cambridge, Mass., earlier in 1957.

But the United States entered the space age set firmly against it. The country's scientific establishment was in disarray, not because of Soviet competition but because of internal neglect. In those days, the Department of Defense (DOD) was the mainstay of much basic research. Tight funding had been exacerbated by changes in DOD accounting practices. Research contracts were being canceled and contractors asked to fund projects out of their own pockets. Research teams were in danger of breaking up. There was truly a homemade crisis in U.S. research.

Added to this was an administrative decision to de-emphasize space research, in terms of both advance planning and present operations. For example, air force scientists changed references to space to read "upper atmosphere" in their research reports. President Eisenhower himself ordered Wernher von Braun's Redstone rocket team, an army-funded group, not to preempt the navy's launch of the Vanguard satellite for the International Geophysical Year. Von Braun could have beaten the Soviets into space had he been allowed to do so.

*(Continued on p. 86)*



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# How Engineering Is Like Baseball

"WHAT should I do if I am assigned work that is not in the best interests of society?" The deeply troubled young man who asked me this was an engineering student soon to graduate and embark on a career. I have lately met other young engineers with similar misgivings.

When I was in school we didn't worry about such matters. We had concerns aplenty, but they were of a different kind: What sort of work did we want to do? What were we good at? How could we best achieve success, whatever that was? As for loyalty, it never occurred to us that conflicts could arise. We assumed that an engineer was loyal to superiors, colleagues, and clients, and that service to society came naturally in the wake of a job well done.

Today, in an era of environmentalism and rising doubts about technology, such a view appears naive. If engineering projects turn out to be harmful—to the environment, say, or public safety—then it is possible for one's professional work to run counter to one's obligation to society. This gives rise to the question put to me by the frowning student, one that obviously has no easy answer.

After a moment's thought, I assured the young man that he was unlikely to encounter the moral crisis he feared. I could say this with some confidence because all the engineers I have ever met have been well content that their work contributes to communal well-being. But I had never given much thought to why this is so. As I reflected on the way most people manage to blend personal morality with loyalty and commitment, I found myself thinking about the trade of Eddie Stanky.

### Team Spirit

In the late 1940s Stanky played second base for the then Brooklyn Dodgers. He lacked outstanding talent but was known as a great competitor. He was particularly adroit in reaching first base by managing to be hit by a pitched ball, he was also successful in distracting opponents with


unexpected gestures and remarks. One day I was horrified to learn that this dirty player had been traded to the team I rooted for—the New York Giants. But then a strange thing happened: once he was playing for my team he seemed morally reformed. We Giant fans no longer called him a bad sport or a dirty player—he was spunky little Eddie, clever little Eddie, resourceful little Eddie. That was one of my earliest lessons in the relativity of ethics.

I told my questioner about this experience. It may seem frivolous to compare such an incident to the moral dilemmas of engineers, but I think the analogy is worth considering. Is it not true, at work or play, that we instinctively "root for the home team"? Of course, we do not condone real knavery, but we tend to view our own cause in a favorable light. Engineers who work for Exxon feel differently about offshore drilling than they would if they were employed as town engineer for a seaside resort. This has less to do with good and evil than with where one stands at a given moment. Petroleum engineers feel they are called upon, both by their company and society, to provide an adequate supply of oil at a reasonable price. Town engineers are responsible for the well-being of the people who rely upon them to keep their community safe, clean, and prosperous.

Obviously engineers' attitudes are largely formed by their assignments. Not only will they feel obligated to perform the work for which they have had been engaged, but they also will find their fellow workers, by and large, to be decent people with whom they will want to join in common cause. From the outside, Exxon may sometimes appear to be a giant, heartless corporation obsessed with making profits. From the inside, Exxon is doubtlessly perceived as an association of earnest individuals working hard on constructive projects. "Groupthink" is a well documented phenomenon from which none of us is immune.

"But isn't that bad?" the troubled student asked. "Not necessarily," I replied. Nobody wants a professional to pledge blind allegiance to an employer or client. But since the prerequisite of accomplishment is effort, society is clearly well served if most people approach their work with zest, even if the zest is founded in something as apparently trivial as team spirit.

The student and I did not have time to pursue the discussion further. Later, however, I wondered if my answer had not rung hollow. After all, the classic response in such an encounter has always been "to thine own self be true." Yet I could not persuade myself that this was what one ought to stress to a young person preparing for a first engineering job.

In addition to enthusiasm, the good work that assures communal well-being requires order and cooperation. Any group of people undertaking a complex task must establish an organizational structure. Without assigned responsibility—without discipline—large-scale technological enterprise is unthinkable. Accordingly, a young engineer will have to temper personal misgivings with an awareness of the group's need for order. One's particular point of view cannot always, or even usually, prevail. We learn to accept this in politics and proudly call it democracy. Why, then, in our professional life should we anticipate the possibility of quitting our job in protest or having to "blow the whistle"? We do what we can to influence the tide of events without being excessively disruptive. It is called working within the system.

Society's interests are better served, I believe, by the resolution of conflict between organizations than by the disaffection of individuals within organizations. Let oil companies search for oil—not recklessly, without care and common sense, but enthusiastically, without the kind of inner dissension that results in paralysis. Let the rest of us establish the limits beyond which we do not want the oil

*(Continued on p. 86)*

SAMUEL C. FLORMAN, a civil engineer, is author of *Engineering and the Liberal Arts, The Existential Pleasures of Engineering,* and *Blaming Technology.*



ILLUSTRATION: JON McINTOSH

# Thermal Conduction Module

IBM

To: Jim
From: Bill
Subject: IBM Technology

I've been reviewing some of our past and present technological achievements, and it occurred to me that the scientific, engineering and academic communities might like to know more about them. Will you select one from the following list as the first topic? Thanks.

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Input/output channel
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FORTRAN
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First automated transistor production
Chain and train printers
Input/Output Control System (IOCS)
STRETCH computer
"Selectric" typewriter
SABRE airline reservation system
Removable disk pack
Virtual machine concept
Hypertape

System/360 compatible family
Operating System/360
Solid Logic Technology
System/360 Model 67/Time-Sharing System
One-transistor memory cell
Cache memory
Relational data base
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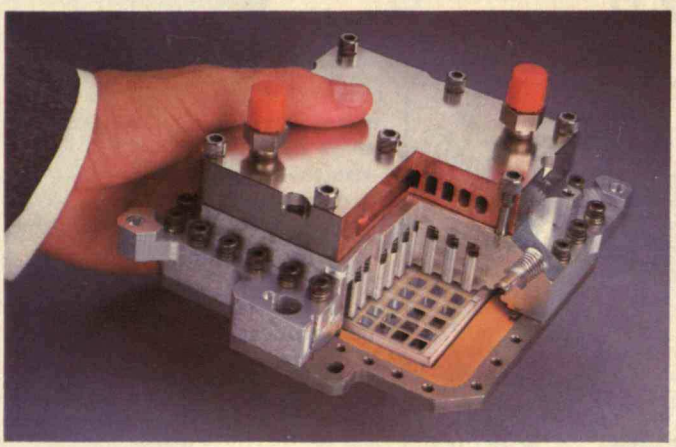
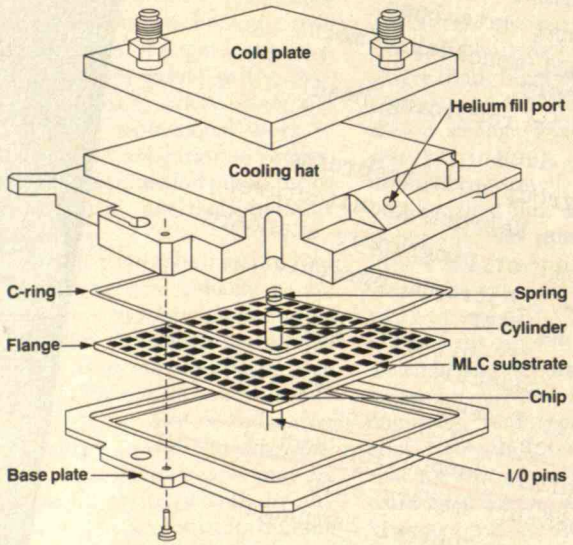
Jim



*Cutaway of TCM (15xl5x6 cm) which contains logic and buffer memory equivalent to an IBM System/370 Model 148. Its new packaging, cooling and assembly technology provides IBM's largest computers with the greatest circuit density yet reported.*



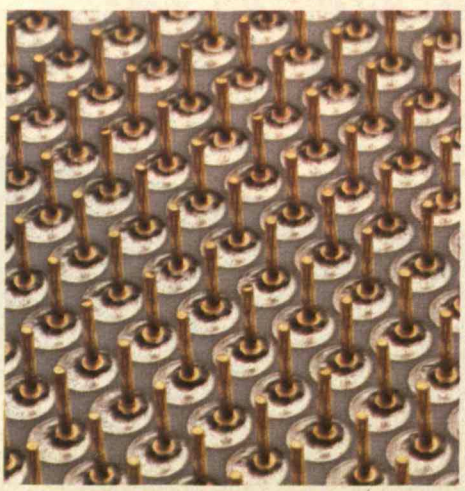

*Exploded view of TCM assembly.*

The time it takes a signal to travel between circuits is key to a computer's performance. The shorter the distance the signal has to travel, the faster the computer can operate. Shortening the distance requires improving the circuit density of the packaging and interconnections, as well as placing the circuits closer together on the logic and memory chips.

Circuit packaging in IBM's most powerful computers—the 3081, 3083 and 3084—is the densest yet reported in the industry. This has been made possible by our Thermal Conduction Module (TCM) and the way it is combined with a high-performance circuit board.

A TCM holds up to 133 logic and memory array chips on a 90-mm substrate, consisting of 33 layered ceramic sheets. More than 120 meters of wiring within these layers connect up to 45,000 circuits within the TCM. And 1,800 pins are brazed to the substrate bottom to plug the module into a circuit board.

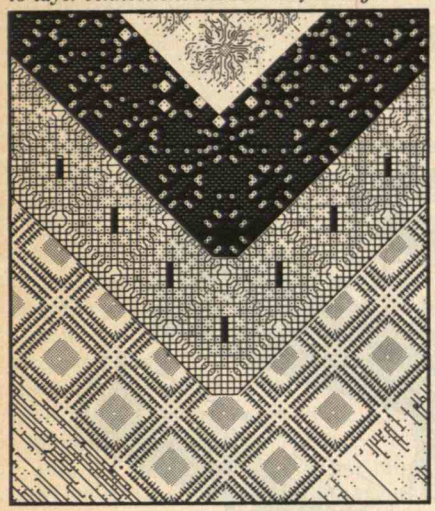
All of this requires computer-aided



*Detail of input/output pins brazed to back of multilayer ceramic (MLC) substrate which plug TCM to next level of packaging.*

# Thermal Conduction Module

*Magnified portion of ceramic sheets (0.2 or 0.28 mm thick, unfired), the basic building blocks of the 33-layer MLC. A typical substrate contains 350,000 vias for layer-to-layer connections and 130 m of wiring.*



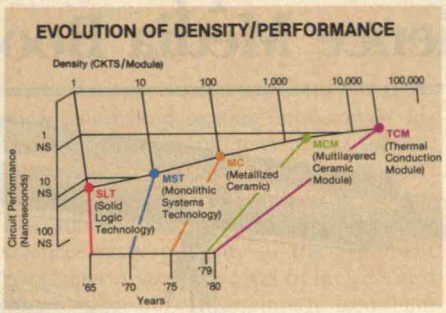
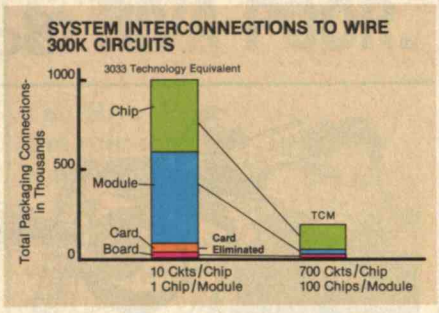



*Illustration of TCM's dramatic benefits. Average performance improved more than 20x over 1965 level. Average circuits/module increased from one in SLT to 30,000 in TCM.*




*Effect of TCM technology on hypothetical 300K circuit system. Circuits/chip and chips/module increased with dramatic reductions of system interconnections and elimination of card-level package. Result is lowered cost, improved performance and reliability.*

design techniques and precision manufacturing operations unique to IBM.

Thus "packaged," the chips require a new cooling mechanism to remove the heat created by their unprecedented density. Within the hermetically-sealed TCM, spring-loaded cylinders contact the chips and conduct heat away from them. Helium surrounds the chips and cylinders, providing an inert atmosphere. Its heat-conducting efficiency is approximately six times that of air, and it carries the heat to an aluminum alloy "hat" atop the TCM. The heat is then conducted to a cold plate through which water circulates at 24°C.

The circuit density of the TCM required IBM engineers to develop a high density, high-performance printed-circuit board on which to mount the modules and to provide power and signal paths. This board is the densest yet reported for large-scale manufacturing.

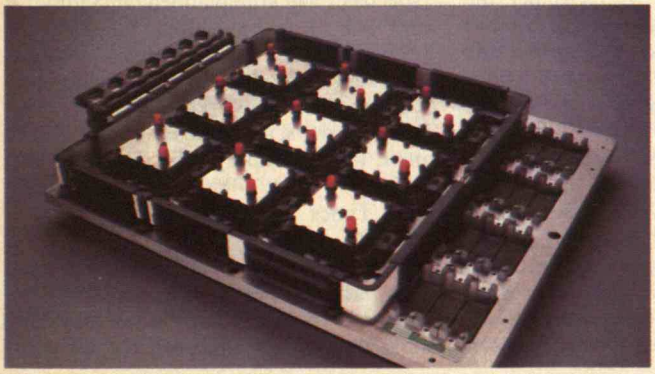
This 600 x 700 mm printed-circuit board contains 20 layers of circuitry, and includes more than one kilometer of wiring. It can accommodate up to six or nine TCMs depending on the board configuration.

Together, the TCM and the circuit board eliminate an entire level of packaging previously required in computers. This combination contains all the functions normally attributed to modules, cards, boards and interconnecting cables in prior technologies.

The circuit density made possible by this new packaging, cooling and assembly technology allows a single TCM to contain as much logic and buffer memory as an IBM System/370 Model 148. Today's large-scale IBM 3081 carries up to 26 TCMs on four circuit boards which contain its complete logic—nearly 800,000 circuits—and displace only four cubic feet.

IBM scientists and engineers worldwide have contributed technologies to the TCM. These technologies are all part of our continuing commitment to research and development, funded with more than $8 billion over the past seven years.

IBM®

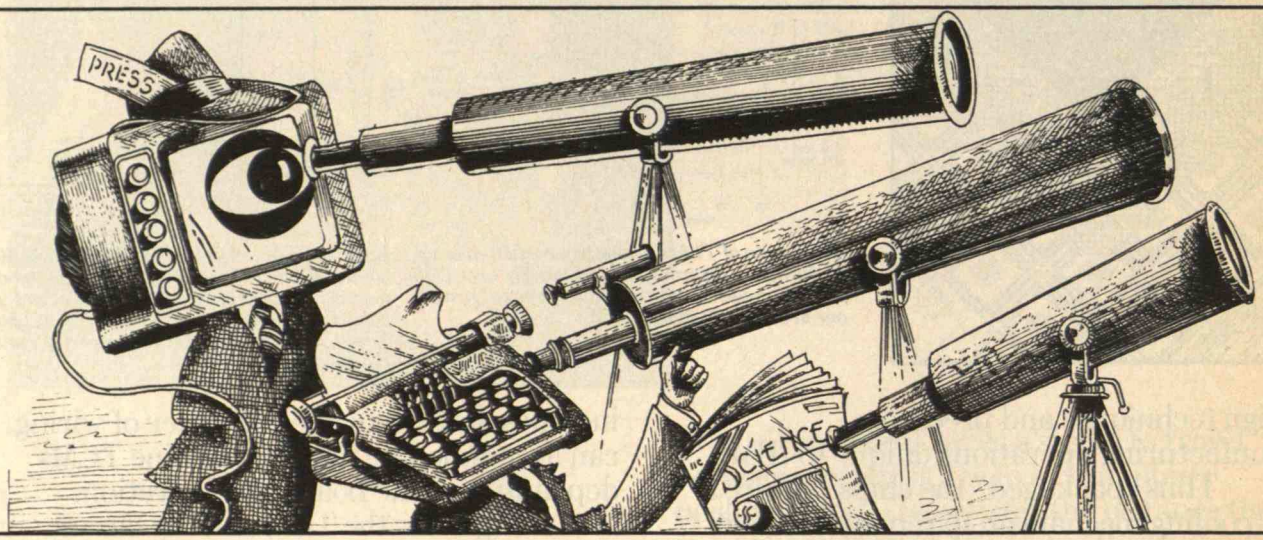


*This 3081 printed-circuit board carries nine TCMs and is, in itself, a major advance in circuit packaging.*

*A recent issue of the IBM Journal of Research and Development is devoted to the IBM 3081. For a free copy, write: Director of Technical Publications, IBM Corporation, Dept. 400, 44 S. Broadway, White Plains, N.Y. 10601.*

BY FRED JEROME

# Whatever Happened to the Science Media Boom?




**Science shows now hot items**

Science shows are suddenly finding a huge audience on television. . . . The new CBS science magazine, *Walter Cronkite's Universe*, cracked the Nielsen 20 with its premier show in June, attracting 34 percent of the viewing audience. . . . Even more impressive, though, is the hot sales picture for *Omni: The New Frontier*, the most sought-after new syndicated show of 1981-1982.

*Boston Globe*, July 30, 1981

Item: July 1982. ABC-TV says it will not renew its contract with the company producing *Omni*, and will discontinue the weekly show after less than a year on the air.

Item: August 1982. CBS-TV announces cancellation of *Walter Cronkite's Universe* after a second summer series. The network cites poor ratings as the reason.

Less than three years ago, the media heralded the arrival of science as their newest star. Most of us involved in science communications welcomed what we viewed as the long-overdue dawning of a bright, new day in popular coverage of science and technology.

Radio, television, and newspaper reporting of scientific developments had increased sharply. Many papers, most notably *The New York Times*, had launched weekly science sections or at least science pages. Colleges around the country began adding courses in science writing to their journalism curricula. Magazine racks on airplanes and in dentists' offices were suddenly crowded with science publications. Three new popular science monthlies were launched in 1980—*Discover, Science 80* (now *83*), and a revamped *Science Digest*—and all quickly passed the half-million mark in circulation.

Carl Sagan arrived in our living rooms via the magic tube, bringing with him the majesty and magnificence of the *Cosmos*. And as sure as *Tonight* followed *Today*, CBS followed with warm, witty Walter Cronkite probing the *Universe*. *Omni*, produced by *Penthouse*, arrived on ABC with yet more phenomenal phenomena, and Don Herbert (TV's Mr. Wizard of old) developed 80-second science spots called "How About . . ." for use during television newscasts around the country.

The print media were still not finished innovating. In January 1982, under the headline "Science Magazines: The Second Wave Rolls In," *Science* announced the arrival of six new publications—*Technology, High Technology, Technology Illustrated, American Health, Science Week*, and *Current Controversy*.

But something seems to have gone wrong with the success story. By June of last year, two of the heralded "second-wave" science magazines—*Technology* and *Science Week*—were out of business. (*Technology* published only three issues; *Science Week*, sponsored by the Council on Higher Education, failed to publish its first issue despite a high-powered promotional mailing.) At least one major North American newspaper, the *Toronto Globe and Mail*, put off plans to initiate a weekly science section, and *Newsday*, the successful Long Island daily, postponed its plans for a science section "until late in 1983," according to managing editor Tony Marro.

In the electronic arena, the most significant reflections of this sudden change of fortune were the back-to-back cancellations of *Omni* and *Universe*, the two prime-time network efforts at popularizing science. The bright, new day of science coverage by the mass media had turned decidedly cloudy. If Walter Cronkite couldn't make it work, who could?

Despite these difficulties, it would be premature to sound the death-knell for mass-media science. Editors and producers of many ventures insist that their products are thriving. *Discover's* circulation neared the 1 million mark by the end of 1982. A number of network science TV "specials" are still planned, including at least one more hour-long *Discover* program (produced by Time, Inc.), and several cable TV projects in science and technology are in the works.

Still, if the science-media bubble hasn't burst, it has certainly been deflated.

## Hard Times

While attempts to explain what happened vary, part of the explanation is clearly the sagging economy. In hard times, magazine subscriptions are squeezed out of most



ILLUSTRATION: ROGER LEYONMARK

family budgets. More important, companies cut back advertising outlays.

For example, *Science Week* editor Corbin Gwaltney cited "the contributing bad economy" as a key factor in the decision not to publish. And even some established publications have suffered—the circulation rate base of *Omni* magazine dropped by more than 100,000 and that of *Scientific American* by some 65,000 during recession-plagued 1982.

But the disappointing Nielsen ratings for *Universe* and *Omni* cannot be blamed on the economy. (A "30-share" has long been considered the minimum for survival of a prime-time series, although this figure has been lowered recently as network audiences have declined. In November 1981, a typical month, the *Omni* rating in Los Angeles, one of its better markets, showed an 18-share. *Universe* did better, but not enough to satisfy network decision makers.) The cancellations may have resulted from the networks' own action and inaction—specifically, the failure to promote the programs adequately combined with poor time-slotting.

*Universe* staffers were not surprised by the network's decision to drop the series. They point out, with some bitterness, that CBS never seriously publicized the program and relegated it to summer evenings —the rerun season—almost certainly sealing its fate. Also, the first *Universe* segment, which drew 34 percent of the audience, was aired on a Sunday evening following *60 Minutes*. The series was then switched to midweek and the ratings, as might well have been expected, plummeted some ten points in one week and never recovered. Pointing out that audience mail for *Universe* was unusually large and enthusiastic, Cronkite argued—in vain—to move the program back to Sunday evenings.

Promotion, of course, is a function of the budget. But it is also a function of the network's top brass. In other words, a corporate commitment carries clout when it comes to publicity. Unfortunately, network executives have yet to make that commitment to science programming. Maybe if the Russians (or the Japanese) achieve another space spectacular, a la *Sputnik* . . .

### Attentive Public?

One theory explaining the poor TV ratings and the failure of other media efforts could hold serious implications for the role of science and scientists in society. According to this position, only 10 to 20 percent of Americans—called the "attentive public"—are really concerned about science. Sixty percent, so the argument goes, have a very low level of interest and tend to filter out any attempt to feed them science. Thus, it's pointless to try to reach them. If anything, the science media should aim for the "middle" 20 percent who may be reachable.

The most outspoken advocate of this position has been Jon Miller of Northern Illinois University, who cites a 1978 National Public Affairs study (which he helped conduct) to support his categorization of different "publics." Many in the scientific community may secretly welcome Miller's ideas. After all, they justify the latent, and not-so-latent, elitism by which so many scientists for so long have kept themselves apart from (in their minds, above) the general public: "If the vast majority of people can't be reached by science and technology, then why should I try?"

Not all scientists feel that way, of course—probably not even most. A recent study of 150 Ohio scientists, by Sharon Dunwoody and Byron T. Scott of Ohio State University, found that 75 percent "would welcome contact" with journalists. And our own experience at the Scientists' Institute for Public Information (SIPI), with the Media Resource Service, indicates an overwhelmingly favorable response from scientists asked if they'd be willing to answer media questions.

What's more, there is considerable evidence that the general public is *not* inattentive to science and technology. Numerous readership surveys conducted over the past 25 years—most recently a 1979 study by the Gannett newspaper chain—repeatedly confirm that readers consider science articles "among the most interesting of all newspaper items." The most widely cited factor convincing executives at Time, Inc., to launch *Discover* in 1980 was the unexpected best-selling popularity of three recent issues of *Time* with science cover stories. (*Newsweek*'s cover story on Einstein's physics was also a best-seller.) *(continued on p. 87)*

FRED JEROME is director of the Media Resource Service of the Scientists' Institute for Public Information in New York. He teaches journalism at N.Y.U. and the City University.

# The 1983 Mercedes-Benz 300 D Turbodiesel: America's best-performing diesel is also one of the world's most civilized sedans.

**A diesel that loves hills and sprints away from stoplights... a sedan that laps up sports car roads. The 300 D Turbodiesel is both. Meanwhile, it coddles you and your passengers in that secure comfort unique to the automobiles of Mercedes-Benz.**

Mercedes-Benz engineers have extracted more sheer power from the 300 D Turbodiesel Sedan's five-cylinder engine than any other engineers have yet extracted from any other passenger car diesel, huge domestic V-8's included.

Their secret was to couple an advanced engine design with a power-boosting turbocharger. Even other turbocharged diesels are left flatfooted; this spacious, solid, 3585-lb. five-passenger Mercedes-Benz sedan ranks as the best performer of any diesel automobile sold in America.

The 300 D Turbodiesel is meanwhile perhaps the most *conscientious* performance automobile in America, because it is so inherently efficient that EPA figures show 27 mpg city estimated and 33 highway* An almost uncanny *balance* of power and frugality is thus struck.

So exotic is engine technology that the interior of each moving piston is constantly cooled by precisely timed jets of oil. But deep down this is still a diesel: a rugged, reliability-minded diesel that will never require a conventional tune-up.

### Do not disturb

Over-the-road performance is superb. This means not only that the 300 D can swallow up roller-coaster back-country roads, and nip rather than lurch around corners–but that its occupants usually feel so *undisturbed* in the process.

Generations of Mercedes-Benz engineers have toiled since 1931 to develop, refine, and refine again the principle of four-wheel independent suspension that is primarily responsible.

These engineers have endowed the car with an exquisitely responsive steering mechanism, guided by 24 recirculating ball bearings. It feels liquid-smooth and seemingly frictionless. The shift lever is mounted down on the transmission tunnel–but look again. The quadrant reads P-R-N-D-S-L. It is no mere automatic but a four-speed automatic, and is designed to serve equally well when shifted by hand. America's most advanced automotive braking system is four-wheel *disc* braking. An 11-inch disc brake is fitted to every wheel of every 300 D Turbodiesel Sedan.

Mercedes-Benz engineers care little if the outside world knows that total swept brake area is a massive 456.5 square inches, or that the 300 D's front suspension geometry is devised to help minimize front-end "nose diving" in hard stops. Their main concern is that the driver is better served by these and myriad other technical flourishes.

### Designed, not decorated

Even when fully padded and finished, the interior of the 300 D's welded steel body shell measures almost five feet in width–sufficient to easily accommodate three adults in the rear seating area, for example. Electronic cruise control, AM/FM stereo radio/cassette player, automatic climate control system and electric window lifts–whatever conventional luxury sedans furnish by way of real conveniences, so does this sedan.

Garishness, however, is absent. The instrument panel is no entertainment center twinkling with gadgetry but an exercise in ergonomics, meant to ease the driver's task by simplifying it.

The engineers continuously strive to make driver controls fewer and less awkward to use, and so reduce driving complexity. Item: the single steering-column lever that lets you perform nine different driving functions–without taking your hands off the wheel.

Seats are not designed to *look* luxurious but to so support your body that you *feel* relaxed, even after an all-day drive.

Interior wood trim is genuine wood from the Mercedes-Benz shops, handworked and fitted and finished. A small thing, but it epitomizes this car's unremitting honesty of character–as its 120 built-in safety features epitomize its seriousness of character.

### The luxury of retained value

The 300 D Turbodiesel boasts a final and powerful distinction. As a Mercedes-Benz, it shares a name so coveted by American buyers today that after the first three years, the *entire Mercedes-Benz line*–not just a few isolated models–has been shown to retain an average of 84 percent of original value.

If retained value is a form of luxury, then perhaps the 300 D Turbodiesel *is*, after all, a luxury car.

*EPA estimate for comparison purposes. The mileage you get may vary with trip length, speed and weather. Actual highway mileage will probably be less.



**Engineered like no other car in the world**

*The Institute of Jazz Studies is proud to announce its Official Archive Collection*

# THE GREATEST JAZZ RECORDINGS OF ALL TIME

Unprecedented in recording history—the complete and definitive collection of great jazz performances

*"Now it's all together . . . all the best of jazz, at long last, in one place. With all the joy, the sorrow, the vitality that makes jazz great. It gives me a tremendous feeling to know this collection is being done, and I'm delighted to be a part of it."*

—Dave Brubeck

## A collection that only the Institute of Jazz Studies could assemble:

- ***The best of over 60,000 records from the Institute's archives and the vaults of every great jazz label.***
- ***Including rare out-of-issue pressings, unreleased recordings – and studio "takes" just recently discovered.***
- ***The first and only collection to tell the entire jazz story.***

FOR THE FIRST TIME EVER, the greatest recorded performances in the history of jazz will be brought together in a single, definitive record collection.

This unprecedented collection is being issued by the Institute of Jazz Studies, home of the world's largest archive of original jazz recordings. It will include the most important recordings of every major jazz artist who ever lived. And it will span all periods . . . all labels . . . all the great styles that have made jazz the most inventive and exciting music of our century.

### From the world's largest jazz archive

*The Greatest Jazz Recordings of All Time* is the culmination of years of work carried on at the Institute's headquarters at Rutgers University—by a staff of authorities unique in all the world.

As they set about making their selections, no resource was denied them. They considered countless recordings, beginning with the Institute's own archive of more than 60,000 records. In addition, they received the support of all the great jazz labels, whose vaults hold the master recordings essential for this collection.

### The most comprehensive collection ever assembled

As a result, this will be the first collection to capture the all-time best of jazz, as it flourished in each generation. The greatest music from the *golden age*—the dazzling trumpet solos of Louis Armstrong, the biting elegance of Bix Beiderbecke's cornet, and the vital, vibrant piano styles of Fats Waller.

From the era of *swing*—the innovative bands of Benny Goodman, Count Basie, Gene Krupa; the incomparable Duke Ellington; singers Billie Holiday, Bing Crosby; guitarist Django Reinhardt in his "Hot Club of France" recordings.

The best of *bop* and *cool jazz*—with alto sax artists ranging from the fiery Charlie Parker to the impeccably graceful Paul Desmond . . . trumpeters Dizzy Gillespie and Miles Davis . . . the Oscar Peterson Trio . . . Milt Jackson, with the Modern Jazz Quartet.

And the great musicians who are bringing jazz to more people than ever *today*—including George Benson, Herbie Hancock and Chick Corea.

### A collection you could never assemble in any other way

This is a collection that could not be duplicated by any individual. For it draws upon a wealth of rare recordings which belong to the Jazz Institute—including important material just uncovered in the last few years.

Some of these recordings, such as Teddy Wilson's solo piano version of 'Somebody Loves Me,' have actually *never* been issued before. Others have been unavailable for decades—such as Art Tatum's 'Chloe.' And among the most fascinating of all are the previously unreleased studio "takes" of well-known numbers like 'Benny's Bugle' by Charlie Christian and 'I Can't Get Started' by Bunny Berigan.

And all the *classics and hits* of jazz will be here. Unforgettable performances of 'St. James Infirmary' by Jack Teagarden, 'China Boy' by Eddie Condon, and 'Star Dust' by Lionel Hampton.

### The superior sound of proof-quality records

The sound quality of each record will be a revelation. For every vintage recording will first undergo a painstaking restoration. Each will be electronically "cleaned," groove by groove . . . bringing you closer to the actual performance than was previously possible.

Furthermore, the Institute of Jazz Studies has appointed The Franklin Mint Record Society, one of America's leading producers of high-quality records, to press the records for this collection. And they will use a special vinyl compound containing its own antistatic element. In addition, each record will be pressed in an atmosphere controlled "clean room." The result—a pressing of superior fidelity that is also more durable and resistant to dust. A record of true *proof-quality*.

The records will be issued in hardbound albums. Each album will hold a set of four 12" long-playing records. And each will present a specially conceived *program of selections*, which brings together related performances in a way unique to this collection. Accompanying each album will be an expert commentary, written under the supervision of Institute Director Dan Morgenstern.

### Available exclusively by subscription

Throughout the world today, people are rediscovering jazz: realizing anew what a vital musical form it is. If you have a love for jazz . . . whether you follow it avidly or remember it with nostalgia . . . this is an opportunity not to be missed.

The collection is available *only* by subscription. Albums will be shipped at the rate of one every other month, and the price of $10.75 for each proof-quality record will be *guaranteed* throughout your subscription period.

To subscribe now, mail the accompanying application to The Franklin Mint Record Society, Franklin Center, PA 19091, by February 28, 1983.

Louis Armstrong, Stan Getz: Photos by Robert Parent; Ella Fitzgerald: Photo by Raymond Ross; Lionel Hampton, Dave Brubeck: David Redfern/Retna Ltd.; Benny Goodman: Rex Features Ltd.; King Oliver's Creole Jazz Band: Courtesy of the Tulane University Jazz Archive.

This tractor working a soybean field in Arkansas represents the recent trend in U.S. agriculture: bigger farms, bigger machines.

# Growing Pains for U.S. Agriculture

BY STEPHEN BUDIANSKY

A cartoon appeared not long ago in the *American Agriculturalist*, a level-headed journal aimed at the modern farmer:

"How's things down on the farm?" asks the feed-store clerk.

"Terrible!" the farmer says. "Prices are way down, costs are up, land prices are out of sight, and they keep raising taxes."

"Well, if things are so bad, how do farmers survive?"

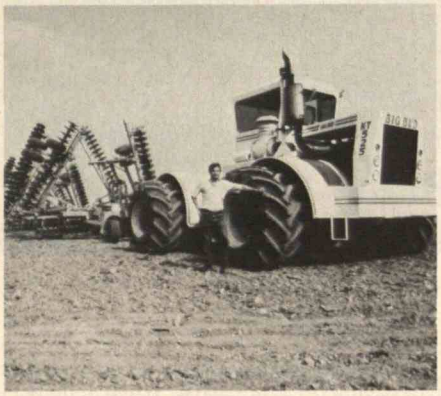
"We plant twice as much."

As a description of what has happened in American agriculture during the last 30 years, that's remarkably on target—farmers are indeed planting twice as much. In 1950, the average farm was 212 acres; today it's 429 acres. And intertwined with the steady growth in farm size (and the drop in farm numbers: over that same period the number of farms dropped by slightly over half) has been a steady growth in the size of farm machinery.

What worries small farmers—and they are joined by many farm analysts, including economists at the U.S. Department of Agriculture (USDA)—is that the two trends are not only intertwined but are feeding off each other. The result, they say, is that farmers have become locked into a cycle of expansion.

According to USDA statistics accumulated since the turn of the century, the push that got expansion started was simply increasing costs. In 1910, farmers spent just over $3.5 billion to pay operating costs. In 1980, they spent $128 billion. By itself, that is probably not surprising. The shock comes when you compare that increase, roughly a factor of 40, to the increase in farm income over the same period. Farmers cleared $2 billion in 1910 versus $11.5 billion in 1980—an increase of only a factor of 5.

And the gap between expenses and income has been widening recently. Energy costs alone have taken an enormous toll. The outlay for fuel and oil for all farms jumped from $1.7 billion to $8.2 billion between 1970 and 1980. And the cost of fertilizer, usually made from natural gas, rose from $2.3 billion to $8.7 billion.



*"Bigger is better" has become the farmer's key to success. But this approach is running into serious obstacles—from economics to erosion—and one alternative cropping up involves planting without plowing.*

STEPHEN BUDIANSKY is Washington reporter for the British scientific journal *Nature*. He lives on a 12-acre farm in Maryland.

### More and Bigger

In the face of these spiraling costs, only farmers who have been able to expand have been able to maintain their incomes. Many small farms simply do not produce enough income to support a family. "The small family farm lives, but it isn't living as we once knew it," says Luther Tweeten, an agricultural economist at Oklahoma State University. "Replacing full-time farmers are part-time farmers who derive most of their income—and expend most of their labor—off the farm." In fact, USDA estimates that about 75 percent of small farms are now part-time operations.

If costs supplied the push for farm expansion, several other factors have eased the way. The first has been easy credit. This was particularly evident in the 1970s, when inflation—which boosted the value of farmland at an especially fast rate—put farmers in a very good credit position. "Their equity would grow," says Donn Reimund of USDA's National Economics Division, "so they'd take that equity and remortgage their farm to expand."

Farm machinery itself has been another factor. Larger tractors let a farmer cover more land, making expansion possible. Tractors powered by 350-horsepower engines and equipped with four-wheel drive (and which cost more than an average home) are now common. Such a tractor can pull a 16-blade plow that turns over a 24-foot-wide swath in a single pass. An 80-horsepower tractor, which most

PHOTOS: SOYBEAN DIGEST AND GRANT HEILMAN PHOTOGRAPHY

**Erosion carries away four billion tons of topsoil yearly, partly because large fields and machines lead farmers to abandon traditional control measures. Since the soil isn't turned over in no-till cultivation, erosion drops by 50 to 90 percent. In no-till, crop stubble is left in place; corn at left grows through old stalks. A special planter (right), which needs a smaller tractor, punches seeds into the soil.**

farmers in 1950 would probably have considered large, would have a hard time pulling a plow covering a 6-foot-wide strip.

To buy this larger equipment, farmers have taken advantage not only of their increasing equity but also of the federal investment tax credit. This allows farmers to subtract part of the purchase cost—now set at 10 percent—from their final income tax bill. Critics say this encourages farmers to buy larger equipment than they really need. "Then to make better use of the equipment," says Dennis Demmel of the Center for Rural Affairs, a small-farm research and advocacy group in Walthill, Neb., "farmers purchase more land—so it's a vicious circle."

Unfortunately, easy credit and large machinery proved a trap for many farmers in the 1970s. They made expansion so attractive, says USDA's Reimund, that many farmers overextended themselves. Today's average farmer has $350,000 invested in land and machinery. High interest rates, which may have seemed manageable at the time, and a decline in the value of farmland over the last few years are bringing home the consequences of overexpansion.

### Where Will It End?

The standard view of the future of farm expansion is captured in the "sky's-the-limit" image that equipment manufacturers still promote—at least officially. International Harvester not long ago sent out an artist's conception of the grain combine of the future, a sleekly contoured mammoth that will harvest 310 acres per day. Today's already huge combines harvest less than 100 acres per day.

Unofficially, there are doubts. According to a senior executive at one leading firm, who asked not to be identified, "Conventional wisdom is still driving major U.S. manufacturers in the direction of 'bigger is better.' We may end up putting ourselves in a vulnerable position."

The reason is that "bigger is better" may finally be running up against some economic and technological obstacles. For example, although rising costs still exert pressure on farmers to expand, the already high farm debt and high interest rates stand in the way. In other words, many farmers are already so overextended that they can do no more. Many economists believe that this is not just a temporary dip in the growth curve; they view it as part of a fundamental shift in the nation's, and the world's, economy. "The capital-energy-labor mix is shifting toward cheaper labor, more expensive capital, and more expensive energy," says Lester Brown of the Worldwatch Institute. "In that world it's not clear there will be a place for $40,000 tractors."

Some traditional assumptions about farm efficiency are also being questioned. A 1981 USDA study, "Economics of Size in U.S. Field Crop Farming," found that an oft-cited rationale for farm expansion—increased efficiency—has little foundation. "In fact," the report concluded, "small farms in many field-crop regions are nearly as technically efficient as large farms. Farmers of all sizes of operations tend to enlarge their farms in search of higher income rather than to increase per-unit cost efficiencies."

A small farm in this study was considered to be around the twenty-fifth percentile in ranking of farm size; this ranges from 60 acres in the southeastern part of the country to 200 acres in the Great Plains. Once a farm reachs about 400 acres—roughly the national average—its owners can achieve most technical cost efficiencies. "Society benefits little in

terms of lower food costs from further increases in farm size," according to the report. "Actually, many commercial farms now exceed the size necessary to achieve all available cost efficiencies."

Another counterforce to further expansion is that the size of farm machinery may be reaching practical upper limits. The largest tractors, even with four-wheel drive and eight tires, begin to lose traction on hilly ground. They are also so heavy—weighing as much as 16 tons—that they can seriously compact the soil. The deep plowing then needed to break up the compacted layers takes "significantly more tractor power" than that needed to plow loose soils, according to a 1982 report by the congressional Office of Technology Assessment. Thus, the advantage of the bigger machines—higher horsepower—is counteracted by their greater weight.

Soil erosion also looms important in defining the limits on equipment and farm size. The trend toward ever-larger tractors and other implements has turned many farmers away from conventional soil conservation practices. The machines work best in wide-open fields, unhindered by windbreaks, fence rows, terraces, and antierosion ditches. Also, the push to expand has led many farmers to till marginal lands—such as those once deemed useful only for pasture—that are especially susceptible to erosion. The result has been that erosion rates have accelerated remarkably. According to the Soil Conservation Service, roughly 40 percent of all U.S. farmland is now losing topsoil faster than it's being replaced—a total of 4 billion tons each year.

### Planting Without Plowing

All these factors—energy costs, capital costs, and soil erosion—have conspired to boost interest in "no-till" farming. In conventional cultivation, soil is turned over with a "moldboard" plow, then harrowed to level out the furrow ridges, and then seeded—each step requiring specific equipment and a trip through the field. No-till cultivation reduces these three steps to one. The soil is not turned over; instead, the stubble and other residue from the previous year's crops is left in place. A special no-till planter is used to punch the seed through the surface trash and into the untilled soil.

Since the topsoil isn't exposed to wind and rain, erosion is sharply reduced. According to the report of the Office of Technology Assessment (OTA), field studies show a 50 to 90 percent drop in soil erosion with no-till farming. The Soil Conservation Service (SCS) and the National Association of Conservation Districts (NACD) enthusiastically endorse no-till. For example, Peter C. Myers, chief of SCS and a Missouri farmer, has been quoted as saying farmers should send the moldboard plow "to the junkyard."

No-till also saves energy by eliminating several passes over the field. The OTA study reports savings of three to four gallons of diesel fuel per acre. Myers estimates that he saves $10 to $12 an acre in fuel and labor costs. And because no-till reduces planting time and conserves soil moisture, "double-cropping"—growing two crops on the same field each season—is often possible.

Perhaps most significant, small-farm advocates are giving no-till a cautious endorsement for its potential in holding down machinery size and capital investment. According to NACD's Jim Lake, "You can use smaller machinery simply because you're not turning the ground over 8 or 10 inches deep, which needs lots

PHOTOS: TIM McCABE AND GENE ALEXANDER, SOIL CONSERVATION SERVICE

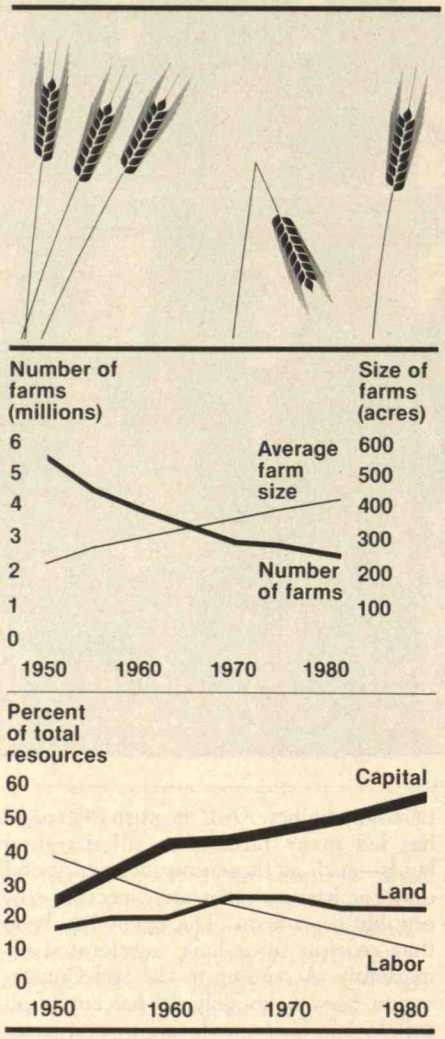
of pull." That is, by eliminating the need for plowing—the operation that demands the greatest power from a tractor—the rationale behind owning the largest tractors disappears. "If a farmer is using a six-row (no-till) planter, an 80-to-100-horsepower tractor is plenty," Lake says. "For that same farmer using regular equipment, his smallest tractor would be 140, 150 horsepower, right on up to 200 horsepower and larger."

What's more, no-till cultivation demands closer attention to the land—not always compatible with the sprawling size of the largest farms. Soil moisture, fertilization, weed control, and planting time are much more critical with no-till—details that Lester Brown says "can literally be plowed away with the moldboard plow." So just as the larger machinery became a force unto itself, no-till may be a force pushing the other way.

Of course, no-till isn't without problems. For example, some farmers find their harvests a bit smaller until they gain experience with the technique. Also, since the soil and plant residue isn't turned over every year, herbicides are generally applied heavily to control weeds, a practice critics are quick to point out. However, no-till's defenders maintain that most common herbicides are relatively safe, having been reformulated after years of criticism. They also note that many conventional farmers apply heavy doses of herbicides to cut down on mechanical weed control. And with no-till, the surface trash left on the ground reduces the runoff of herbicides into lakes and streams.

### Spreading Fast

According to the SCS, nearly 100 million acres (out of 413 million under cultivation in the country) were planted without plowing in 1981. This includes farms whose owners use no-till as well as other methods of "conservation tillage" that don't turn over the soil. Many analysts predict that farmers will continue to move in this direction—and not just small farmers. Says NACD's Lake: "Increased attention to soil erosion, coupled with the inflationary cycle that farmers have been caught in the last few years—high fuel costs, high interest rates—have got the large farmer, the guy who's making a good living farming and who was just giving soil conservation lip service before, interested in conservation tillage."




**Farmers caught in cycle of expansion. The number of U.S. farms has dropped by half while farm size has doubled. Larger machines helped this expansion but also increased farmers' capital investment and reduced human labor.**

How the farm-machinery industry responds will be a key factor in how fast farmers adopt no-till cultivation. So far, its attitude has been equivocal. "The manufacturers have been scared to death of no-till and have resisted it," says Lester Brown of Worldwatch. They make their biggest profits on the biggest machines, and no-till doesn't involve big tractors. Nor does it require the large plows and harrows that fetch tens of thousands of dollars apiece. One International Harvester dealer in Frederick, Md., didn't even want to talk about no-till, and indeed the company does not mention the words "no-till" and "conservation tillage" in its latest catalogue.

Significantly, small manufacturers have been at the forefront of no-till. And, in a virtual carbon-copy of the automobile industry saga, the Japanese have led the way in developing small tractors. But some changes are taking place. Jim Lake and others involved in promoting no-till find the chief resistance among those in the corporate ranks directly involved in sales—the ones responsible for moving a large inventory of unsold tractors and plows. However, industry officials involved in long-range planning are beginning to accept no-till. Lake notes that the large companies have recently begun working with NACD on plans to set up a national information center on conservation tillage.

More broadly, the message is getting through that innovation doesn't have to be confined to large machines. Steve Gage, vice-president for science and technology at International Harvester, acknowledges that much can be done to improve small-tractor design, such as the use of lighter materials. And speaking about mid-sized tractors, he says, "If I had an area to target for the nineties, that would be a ripe one to look at."

But even were they willing to support no-till, the financial predicaments of some large manufacturers, including International Harvester, could make it difficult for them to undertake substantial development efforts. "This company," says Gage, "with its cost structure, could not possibly compete in making tractors like that." Harvester recently sold out its very popular line of 8-to-20-horsepower tractors for that very reason.

There's another problem, too. "The farm-implement business is very slow to change," says Gage. "It prides itself on being market-driven. But there's such a delay in translating market forces to new products [Harvester's new axial-flow combine, for example, was 17 years in the making] that it may be yesterday's market that's driving the system."

As Wesley Buchele, an Iowa agricultural engineer, points out, "The farmer farms as his machinery systems allow him to farm." This means that small farmers still have a chance, but they face the proverbial tough row to hoe. □



DIAGRAMS: OMNIGRAPHICS

# The Dispersion Analysis

# The Dispersion Analysis

*Exhaust dispersion near a roadway is influenced by the turbulence and heat generated by moving vehicles. Findings at the General Motors Research Laboratories have provided a new understanding of the dispersion process.*

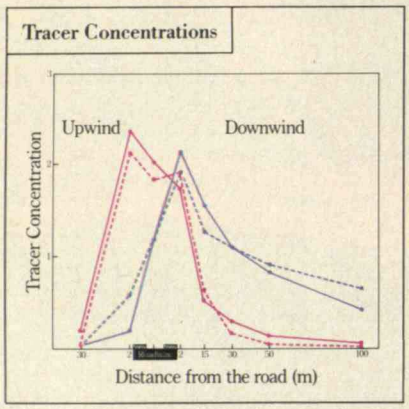



*Figure 1: Observed (solid lines) and predicted (dashed lines) tracer concentrations near ground level as a function of distance from the edge of the road. Blue lines indicate the case in which the wind is perpendicular to the road; red lines, when the wind is nearly parallel to the road and opposing the upwind-lane traffic.*

*Figure 2: This representation of a roadway viewed from above shows the location of large vortices formed by local wind shear when the wind opposes the upwind-lane traffic.*

BY USING the conservation-of-mass equation, one can describe the dispersion of gaseous molecules in the atmosphere. The equation includes terms for advection, diffusion, sources and sinks. Advection is the transport of air parcels by the mean wind; diffusion is due mainly to turbulent mixing. But the equation is useful only if we have information about the wind and temperature fields in the atmosphere. Specifically, our ability to predict vehicular exhaust concentrations near a road depends on knowledge of the effects of vehicles on these fields.

The conservation-of-mass equation for the mean concentration of any species, C, is

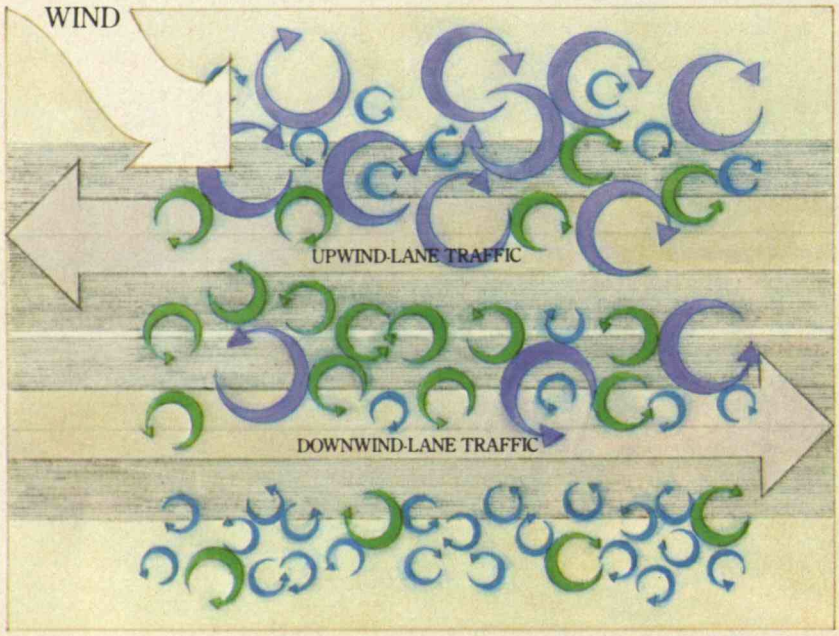
$$\frac{\partial C}{\partial t} + \sum_i \frac{\partial (U_i C)}{\partial x_i} = \sum_{i,j} \frac{\partial}{\partial x_i}\left(K_{ij}\frac{\partial C}{\partial x_j}\right) + So + Si$$

Local rate of change — Advection — Diffusion — Sources — Sinks

where $U_i$ is the mean wind velocity and $K_{ij}$ is the eddy diffusivity tensor. This equation applies when the length scale of mixing is small compared to that of the variation of the mean concentration. Near a road, this condition is met if the averaging time for the concentration and wind velocity is much longer than the time interval of vehicular passage. For a straight roadway, a long averaging time allows one to assume spatial uniformity in the direction parallel to the road, and to ignore the spatial derivatives in that direction.

The input information for $K_{ij}$ and the mean crossroad and vertical wind components near a roadway became available as a result of a large-scale experiment conducted by the General Motors Research Laboratories. The experiment has provided an understanding of the influence of moving vehicles on mechanical turbulence and buoyancy near a roadway. Dr. David Chock was responsible for the design of the experiment and the analysis of the data. The experiment, which duplicated a heavily traveled, level roadway, was conducted under meterological conditions minimizing dispersion.

Moving vehicles affect the mean crossroad and vertical wind components in the following ways. Vehicles act as an obstacle to the mean wind, causing it to slow and move upward as it approaches the vehicles and downward as it leaves the road. In addition, vehicles release heat, which causes a net upward motion. It was established that the increase in the mean vertical wind component due to the exhaust heat was $(B/U)^{1/2}$ where U is the crossroad wind component.



The buoyancy flux, B, is proportional to the heat emission rate of the vehicles.

Moving vehicles also enhance both turbulence intensity and mixing. To determine how this modifies the eddy diffusivity tensor, $K_{ij}$, Dr. Chock invoked a "second-order closure" assumption, which relates eddy diffusivity to Reynolds stresses and the gradients of mean wind velocity and mean temperature. Eddy diffusivity was assumed to be the sum of ambient and traffic contributions. To determine the traffic contribution, the length scale of the traffic-induced turbulence was assumed to be comparable to vehicle height—1.5 m.

USING THE vast data base compiled during the experiment, Dr. Chock was able to specify $K_{ij}$ and the mean crossroad and vertical wind components, and solve the equation numerically. To test the model, half-hour measurements of a tracer gas were used to map out experimentally the exhaust dispersion under various meteorological conditions. The case where the wind speed is low and the wind direction is nearly perpendicular to the roadway is represented by the blue lines in Figure 1. Both the model and the experiment show the same dispersion pattern. The peak concentration is on the downwind roadside.

When the wind is nearly parallel to the road, the situation is much more complicated. Figure 2 shows that when the wind and traffic flow on the upwind lanes oppose each other, a high shear region occurs immediately upwind of the first traffic lane. When the wind and traffic are in the same direction, the high shear region occurs in the median of the road. In these high shear regions, large eddies are generated and turbulent mixing is intense. The red lines in Figure 1 show a comparison of the model's predictions with the tracer data for the case illustrated by Figure 2. Notice that the peak concentration can actually occur on the upwind roadside, due to the exhaust transport by these large eddies. Dr. Chock's model is the first to predict this occurrence.

Under all combinations of wind speeds and directions, the predictions based on the model compare favorably with the measured tracer concentrations. There is little systematic bias with respect to wind direction.

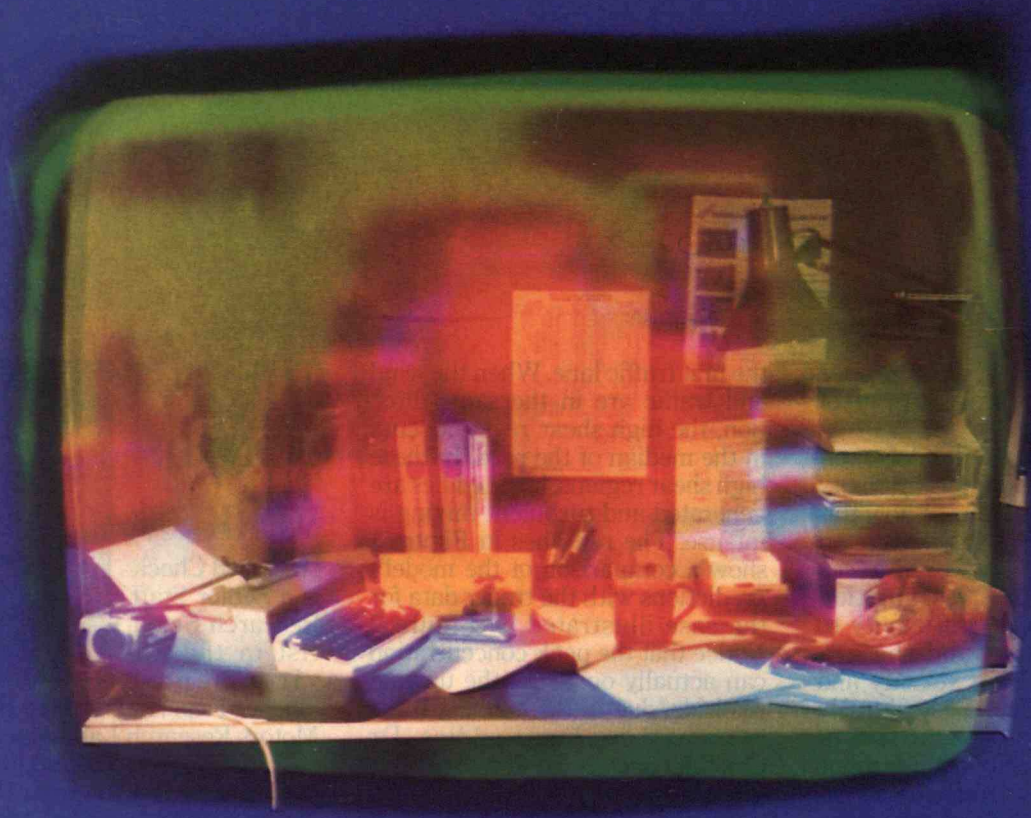
"In light of this new model, exhaust dispersion near a roadway can now be predicted with reliability," says Dr. Chock. "This is of importance for environmentally sound road planning, and opens the door to the investigation of dispersion on city streets, where the presence of tall structures introduces even further complexity."

## THE MAN BEHIND THE WORK

Dr. David Chock is a Senior Staff Research Scientist in the Environmental Science Department at the General Motors Research Laboratories.

Dr. Chock received his Ph.D. in Chemical Physics from the University of Chicago. His thesis concerned the quantum mechanics of molecules and molecular crystals. As a Postdoctoral Fellow at the Free University of Brussels, he did research work on the dynamics of critical phenomena. He did additional postdoctoral work in the fields of solid-state physics and fluid dynamics.

Dr. Chock joined the corporation in 1972. He is leader of the GM atmospheric modeling group. His current research interests include the phenomena of atmospheric transport and reactions, and the statistical study of time-series data.



# The Computer Age Gets Personal

BY HOO-MIN D. TOONG AND AMAR GUPTA

Enormous computing power can now be put on desks in homes and offices. Here is a guide to the building block of the "information revolution."

RAPID advancements in semiconductor technology since the 1960s have made possible tremendous increases in computing power at plummeting costs. Whereas 20 years ago a computer could be afforded only by large organizations, the minicomputers of the 1970s were purchased by departments and groups within such organizations. Now a personal computer is within the reach of all of us.

Today's personal computers offer significant computing capabilities, and they are easy to use, attractive, and increasingly popular for a broad range of day-to-day activities in both office and home. Indeed, they are dramatically changing many facets of our daily lives. Over 2 million personal computers are now in use in the United States; sales were over $3 billion in 1982 and will exceed $6 billion in 1985. Personal computers are no longer a luxury but important tools for increasing productivity in the office, the most labor-intensive sector in the U.S. economy.

The same capability for handling much of the paperwork of modern life—tax returns, mortgage calculations, and other financial transactions, for example—motivates people to use computers at home. However, a major segment of the market involves entertainment: personal computers offer a growing array of games, music, and art far more sophisticated, in terms of speed and capability, than video material based only on television. This advantage results from the ability of computers to store and quickly retrieve large amounts of information.

The future will bring many more uses for computers in both business and home. Indeed, the possibilities are virtually endless.

### Varied Repertory and Friendly Interface

A great variety of computers, large and small, are now available. A personal computer is a machine or system meeting *all* the following major qualifications:

☐ The price for the complete system is under $5,000.

☐ The system is designed to accept secondary memory devices to supplement the primary, built-in memory.

☐ The user is expected to interact with the system continuously, not only at the beginning and end of a problem.

☐ At least one general language (Basic, Fortran, Cobol, Pascal, Ada, or C) is available for this interaction.

☐ The system is usable for a wide variety of problems and is not designed for any single application.

☐ The computer is distributed through mass-marketing channels, with the marketing emphasis on the first-time computer user.

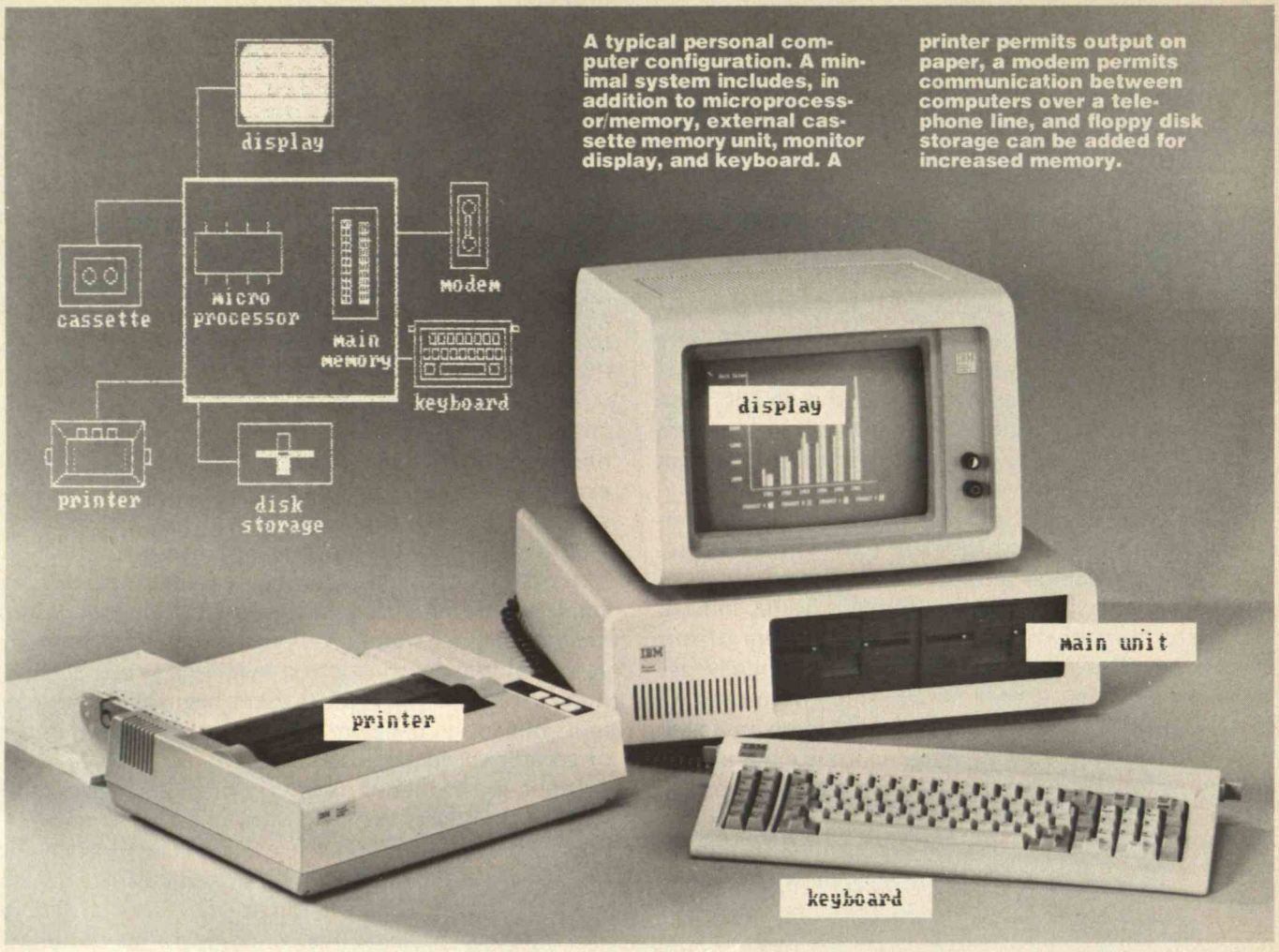
A typical modern personal computer consists of a circuit board with a silicon-chip microprocessor and one or more memory chips attached. The microprocessor can perform hundreds of thousands of calculations every second, and the memory chips provide the primary storage for instructions and data. External storage devices, such as cassette tape units or small recording disks (floppy disks), augment the memory capacity and provide a storage medium that can be physically transferred from one personal computer to another. (Typical users begin with cassette units but soon change to disks to gain the advantages of greater speed and capacity.)

Input is through a typewriterlike keyboard unit. Output typically takes the form of words and numbers displayed either on a television screen or a similar specialized screen called a monitor. Most monitors are designed to display 24 lines of letters and figures, with each line containing a maximum of 80 characters. Adding a printer unit permits output in the form of a printed paper. A special device, called a "modem" (for modulator/demodulator), permits the computer to receive and transmit data over a conventional telephone line.

But the significant factor in defining a personal computer is not its physical features but the characteristics of the operating system. Designers of personal computers and software attempt to provide a friendly human-machine interface, even at the expense of brute computing power. Optional programs are also available so that the computer can be used for many different purposes. Although word processors and hobby computers have many characteristics of personal computers, they lack this flexibility.

Recent trends in microelectronics, memories, input-output mechanisms, and software suggest that the trend in microprocessors is toward larger "words" and higher circuit speeds. A computer capable of handling larger "words" is able to perform a complete operation in fewer machine cycles and to operate directly with larger memory. Both these assets enhance performance by increasing the speed of operations and the number that can be performed in a sequence without the operator's intervention. In addition to greater speed and memory access, these

PHOTOGRAPH: TOM NORTON




**A typical personal computer configuration. A minimal system includes, in addition to microprocessor/memory, external cassette memory unit, monitor display, and keyboard. A printer permits output on paper, a modem permits communication between computers over a telephone line, and floppy disk storage can be added for increased memory.**

larger microprocessors have the advantage of greater accuracy.

The first wave of personal computers used 8-bit microprocessors—that is, microprocessors in which 8 binary digits (0 or 1) can be processed in parallel, giving the capacity to process in a single operation any number up to 256, or to address any of up to 256 points in the memory. Processing larger numbers with an 8-bit microprocessor requires multiple operations, which take more time. Newer systems use 16-bit microprocessors, and 32-bit microprocessors are now available.

Currently, 32-bit chips cost $250, compared with $50 and $8, respectively, for 16-bit and 8-bit chips. As technology improves and costs drop, 32-bit microprocessors will be standard in personal computers by 1990. Until then, 16-bit microprocessors will be the norm.

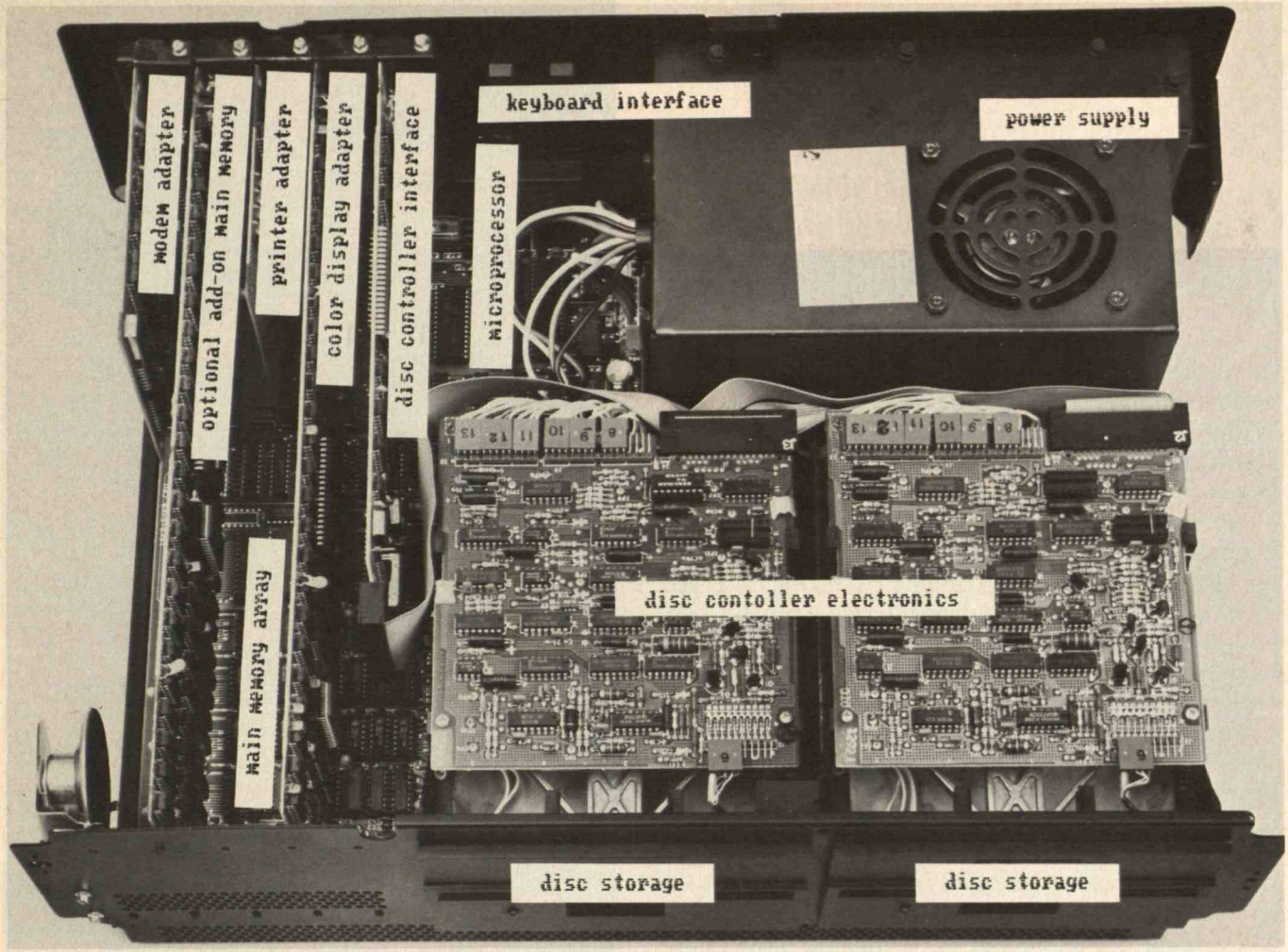
The primary memory in personal computers is of two different types: read-only memory (ROM) and random-access memory (RAM). In the former, information is fixed in the memory at the time of manufacture and is not lost when computer power is switched off. The role of such a ROM is to guide the computer through a fixed procedure, such as calculating square roots or translating a user's program into machine language. In a RAM, nformation such as special programs and data files can be "written in" or "read out" as frequently as desired, with any storage location directly accessible. RAMs are of two types: dynamic RAMs, which are cheaper but lose their stored information unless they are "refreshed" often, and static RAMs, which are costlier but do not need to be "refreshed." If power is lost, both types of RAMs lose their stored information.

Over the past decade, the number of memory circuits per unit of area on a chip has increased by a factor of 64, and cost on a unit basis has been reduced by a factor of 50. Both these trends will continue. So-called 64K dynamic RAMs (each contains 65,536 bits of information [$K = 2^{10} = 1{,}024$; $64K = 64 \times 1{,}024$]) are expected to remain popular until about 1984, when the much larger memory capacity of 256K dynamic RAMs is expected to become standard. Most manufacturers supply system programs on ROMs, and this practice will continue because programs are secure against power failures and users are less able to duplicate programs in this form.

Computers' main memories will be supplemented by secondary storage devices that offer larger and



DIAGRAM: POONAM GUPTA USING EXECU-VISION PACKAGE




relatively inexpensive, though slower, capacity for long-term storage of program and data files. The most popular of these is a so-called "floppy disk"—a disk of mylar coated with magnetic material on one or both sides. Data are stored in a series of spots—either magnetized or demagnetized—along the concentric tracks. Heads for reading or writing data can be moved radially across the disc to reach a specified segment of circular track. Storage capacity depends on the format used for the stored data, the quality of the magnetic surface, and the design of the reading-writing head. Floppy disks in current use typically have capacities of 1 to 4 million bits, sufficient to store 20,000 to 80,000 words of English text. During the next four years, higher-density floppy disks will be common. Indeed, disks offering capacities of 50 to 100 million bits are already becoming popular, but they are much costlier than floppy disks.

The primary display device used in all personal computer systems is a cathode-ray tube (CRT), either standing alone or as part of a television receiver. This system will continue through the foreseeable future. Output is typically presented in alphanumeric form—letters and numbers. Charts and game boards can be presented, but the memory and software required to display such graphical images is often complex and expensive. The letters and numbers in alphanumeric displays are patterns of dots programmed in special ROMs known as "character generators." The quality of the image depends on the number of points (or pixels) on the screen that can be addressed by the computer—that is, the number of points at which dots can be located. A typical low-resolution screen has a field of 6,144 (128 times 48) pixels (*pic*ture *el*ements—dots on the screen). High-resolution systems (100,000 pixels or more) allow sophisticated graphics for animation or detailed figures and may provide color as well.

## The Market and the Players

The personal-computer industry has grown as a direct result of the evolution of the microprocessor. This evolution began when Intel in 1971 packaged a complete, if somewhat limited, processor with a 4-bit word size in a single integrated circuit. The company followed with the first 8-bit processor in 1972 and an improved version in 1974. One year later Micro Instrumentation and Telemetry Systems, Inc. (MITS), an Albuquerque firm, developed the first personal

PHOTOGRAPHS: IBM

computer around Intel's 8-bit processor. The basic system sold for $395 in kit form and $621 in assembled form, not including accessories (peripherals).

Though the MITS system is no longer manufactured, its method for connecting peripherals and the main computer has become an industry standard. Within three years after it was introduced, Radio Shack, Apple, and Commodore had entered the market. Now makers of large computers such as IBM and Honeywell, as well as minicomputer leaders such as Digital Equipment Corp. and Data General Corp., are also making personal computers, having observed their traditional markets being eroded by the new low-priced products. The results are rapid development of the market and growing popular interest and faith in personal computers.

The fact that the pioneering manufacturers did not survive beyond the initial phase of personal-computer development results from their preoccupation with the needs of hobbyists. New entrants such as Radio Shack, Commodore, and Apple captured a major share of the market in 1978 by promoting fully assembled, ready-to-operate systems that were easier to use. Though the success of the companies now in the competition will depend at least partly on their financial and technical resources, their products' ease of use (or "user-friendliness" in trade jargon) is a significant competitive feature.

The personal-computer market can be divided into four segments in terms of the computer's intended use: business, home, research-technical, and educational. The business segment, by far the largest at present, accounted for 750,000 sales (retail value of $2 billion) in 1982, or 54 percent of the units sold and 65 percent of the dollar sales. This segment will continue to be a major factor, with more sales than all other segments put together. No wonder, then, that the leading makers of personal computers are concentrating their sales efforts on the business sector.

There are 14 million businesses and 36 million white-collar workers in the United States, and many are present or prospective users of personal computers. Indeed, personal computers are especially suited to small businesses of ten people or less, including retailers, consultants, and professional offices such as those of lawyers, doctors, and dentists. Sales to larger organizations adopting the "computer-on-each-desk" concept will be a major factor by 1985.

The most visible segment of the personal-computer "revolution" is in homes, where computers are used

for entertainment and education, sending messages, and home finances. The development of appropriate software will soon enable sophisticated users to pay bills, manage bank accounts, compute taxes, and even buy household items without written transactions. The average cost of a home system was $1,250 in 1982, when the home segment accounted for $465 million of sales (375,000 computers). The average cost will be less than $1,000 in 1985 and $750 in 1990. Prices at the low end have already tumbled to under $300, and intense competition has made this market for small computers unprofitable for several producers.

The science segment accounted for 200,000 unit sales at a retail value of $470 million in 1982. Though the small computers available for technical work fulfill the definition of personal computers, they tend to be used for sophisticated calculations requiring more power as well as the capability to interface with other scientific instruments and higher-level languages. Thus, this market is likely to be served in the future by a series of highly specialized products.

The potential market for personal computers in education (60,000 units with a retail value of $120 million sold in 1982) has barely been tapped. In the



PHOTOGRAPH: FRED BRINK

**The personal computer goes public. The rosy forecasts of the 1970s are suddenly coming true: personal computers are proliferating at an unprecedented rate into offices, homes, and schools—the precursor of a tidal wave of change in the way we use and manage information.**

**San Francisco's "Computer Faire" (below) in April 1981 gave a preview of the aggressive marketing now fueled by strenuous competition. Unfortunately, funding problems relegate education (left) to the slowest-growing sector of the personal computer market.**


United States alone there are 3,000 colleges, 29,000 secondary schools, 77,000 elementary schools, and 60 million students, all of whom could greatly benefit from ready access to computing power. For example, computer-assisted instruction would enable interactive learning in many different subjects at a pace tailored to each student's capability. Furthermore, the science and practice of computing—including programming skills—would be part of every student's education.

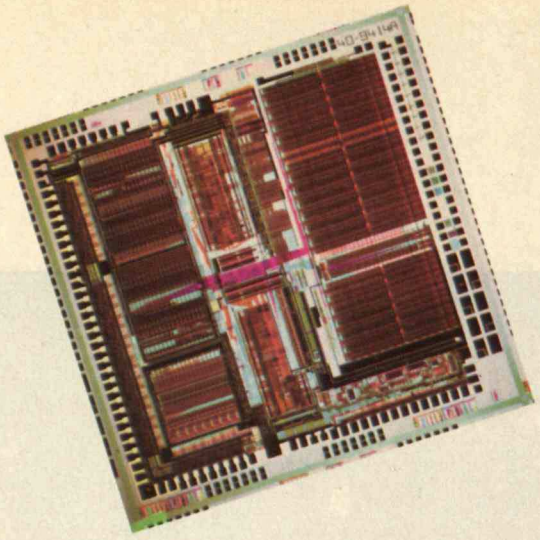
Computer manufacturers recognize that schools are the logical environment in which to develop computer skills, and they have reason to expect that students will purchase the machine on which they first learn computing. So manufacturers are offering many price incentives to the educational sector. Yet the educational sector will continue to account for only about 15 percent of total sales of personal computers for the rest of this decade, as school funding will be limited.

Although they want to serve all four segments, the industry leaders (Apple, Radio Shack, Commodore, IBM, and Xerox) are focusing on the business market. Vector Graphics is also emphasizing this market by tailoring personal-computer systems to the needs of particular industries. Atari (Warner), Intellivision (Mattel), and Texas Instruments are focusing on the home market. Hewlett-Packard is offering a highly specialized compact product with built-in printer, tape memory, and video monitor especially for the scientific community.

In general, both prices and manufacturers' profit margins are falling, and mass marketing is becoming the rule. The major competitors will each spend over $10 million in 1983 on advertising aimed at expanding the market and establishing their place in it.

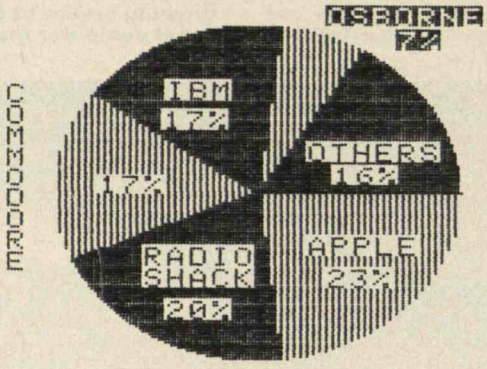
The dynamics of the entire personal-computer market may be substantially changed by new entrants by 1990. Traditional barriers to entry into this field have crumbled. For example, manufacturing capability is not essential: the IBM personal computer is assembled almost entirely from premanufactured components not of IBM origin. By contrast, strength in marketing and distribution is a significant advantage, and many organizations with this capability may seek to replicate IBM's strategy for rapid entry into the field. Organizations such as General Electric, Procter and Gamble, Phillip Morris, and Du Pont all have the ability to enter the personal computer market in this way.

PHOTOGRAPH: CHARLES O'REAR

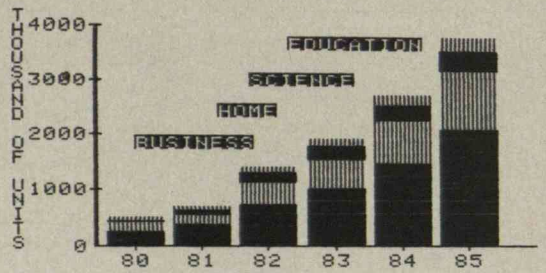


**Above**
**The heart of tomorrow's personal computer. Complex 32-bit microprocessors such as this are now at the leading edge of the state of the art. In terms of processing speeds and ability to reference large programs, such microprocessors compete favorably with mainframe computers of today. These microprocessors will be standard in personal computers by 1990, giving them higher speed and greater capabilities than personal computers of today.**

**Below**
**Locking horns in the volatile personal-computer market. The leaders of the last four years—Apple, Radio Shack, and Commodore—have now been joined by IBM, which acquired almost one-sixth of the market less than 18 months after its entry.**




**Right**
**High technology on a fast track. Personal computer sales have tripled since 1980, and this rapid growth will continue. Sales to business are more than half of the total, with education—constrained by shortages of funds—the market's poorest customer.**




**ESTIMATED NUMBER OF UNITS SOLD IN U.S. BY MARKET SEGMENTS**

## Where to Find the Distributor

Strategies for marketing mainframe computers are not appropriate for marketing personal computers—profit margins are not large enough to justify hiring internal sales forces to sell directly to end users. As a result, producers are now experimenting with a wide variety of distribution strategies:

*Franchised retail chains* constitute a major distribution channel. For example, the Computerland chain sold $200 million worth of computers and related accessories in 1981. These stores distribute the products of many vendors, and their volume is large enough to support a technical and maintenance staff.

*Manufacturer-owned retail stores* have been used successfully by Radio Shack. IBM, Digital, and Xerox have also opened such stores but only to supplement existing distribution channels. Except for Xerox, each manufacturer's stores sell only that manufacturer's products, and a prospective buyer is thus obliged to visit several stores to compare equipment of different makes.

*Department-store outlets* have generally been unsuccessful. Mass merchandisers depend for profits on fast-selling commodities. According to computer-industry data, personal-computer buyers make four shopping trips totaling as much as seven hours when selecting their machines. These buyers also expect sustained support and maintenance services that department stores are unaccustomed to providing.

*Office-equipment stores* specializing in copiers, typewriters, word-processors, and other office equipment are well positioned to reach the most promising future market for personal computers and auxiliary equipment. If these stores can provide adequate servicing, they will become very popular.

*Consumer-electronics stores* such as Tech Hi-Fi have been marketing personal computers with some success, but the lack of expertise at the store level has been a constraint. Japanese manufacturers have also established ties with such stores as distributors of other Japanese products. These channels will become a major factor as the Japanese increase their share of the personal-computer market.

*Independent retailers* often lack the capital required to compete vigorously and are therefore not gaining in numbers and importance as quickly as other retail channels.

*Catalog showrooms* have been used by Texas Instruments, but personal computers require follow-up



PHOTOGRAPH: HEWLETT PACKARD

# Buying Your First Personal Computer

MY NAME is Bill Able. I run a ten-person retail store. Six months ago I decided that a personal computer might help me with my business. My brother-in-law's company had just bought an Apple for every manager to increase productivity. I thought I should get on the bandwagon before it's too late.

I talked to friends and business associates who either had just acquired personal computers or were in the same boat as I, struggling to figure out what to buy and how to use it. But that didn't seem to help too much, so I took a trip down to the local computer store. There I was struck by several interesting points:

☐ There was a big range of computers, accessories, and programs—hardware and software, they called it.

☐ The salespeople could talk a mile a minute with all sorts of technical jargon, which confused me no end. Though the sales talk seemed to vary some from model to model of personal computer, I couldn't really understand what the differences would mean to me as a user.

☐ The salespeople did not seem to have any understanding of my needs, nor did they seem to care.

After two months of reading and several trips to the computer store I was no better off, still trying to understand bytes and disks that were single-density or double-density and printers that could go at the speed of peanut butter or the speed of light or that could print letters but not pictures or vice versa. I decided that the only way to really solve this problem was to take the plunge.

The first month with the personal computer was pure frustration. The manuals that came with the software seemed to be written by programmers for other programmers and not for businesspeople like myself. The accounting package turned out to be designed for a manufacturing company, not for my little store. And I could never figure out how to use the sales-projection software package.

However, by word of mouth I learned about a "spreadsheet" package, and I finally learned how to use it to track my monthly cash flow resulting from sales against the expenses of employees, taxes, heating, lighting, and other overhead items. For example, I can see the impact of altering prices—by changing the quality or the markup—on some of my biggest-selling items: the return on investment isn't always what you think it will be. This single application should help me save over $5,000 in a single year—more than the cost of the computer in the first place.

Apparently these experiences happen to lots of people: the original idea doesn't work out, but another application—and then lots of applications—prove so useful that the computer becomes as important as a typewriter or a telephone. The money and the agony are quickly forgotten.

The three-month warranty on my computer ran out a month back, and since then I've already paid $100 to get the disk drive repaired. But that was worth it, too. When my computer isn't working, it really feels strange now.—*H.-M.D.T. and A.G.* ☐

support that such showrooms have been unable to provide.

*Mail-order firms* offering discounts ranging up to 30 percent appeal to price-sensitive customers, but their total lack of continuing support disenchants users. Price cutting penalizes the full-service dealers on which manufacturers want to rely as major sales outlets. Accordingly, major companies are trying to discourage sales through mail-order firms.

*Direct-sales staffs* are used for large-volume sales to government, educational institutions, and major corporations who prefer dealing directly with the manufacturer. But such direct sales tend to antagonize dealers by depriving them of some of their most profitable opportunities, and profit margins are inadequate to support direct sales to small-volume and individual buyers.

*Value-added houses* serve specialized users with coordinated hardware and software, such as printing companies that need word-processing and typesetting capabilities but have little or no internal computing expertise.

Though franchised retail outlets are the largest sellers of personal computers in the United States, the one compelling characteristic of personal-computer distribution today is diversity. No one form of vendor or market approach is dominant.

### Selecting a Personal Computer

No one should select a personal-computer system without taking into account the tasks for which it will be used and the environment in which it will function. Even within a single business, personal-computer users come from different areas—personnel, accounting, management, manufacturing, research, sales—and have different computing needs. Even within departments there are many possible uses. The personnel department will run personnel files on a regular basis but also may want to study policy questions—the likely benefits in terms of increased revenue from a larger sales force, for example. Furthermore, different users have different strategies for using a computer for *ad hoc* applications. Thus, the person who will use a personal computer should—almost by definition—choose it, partly on the basis of the services it will provide and partly on the basis of its apparent user-friendliness. Indeed, the machine's responsiveness to its user's needs and style is the critical technological breakthrough.

CHART GENERATED USING VISIPLOT PACKAGE

Though a computer should be selected on the basis of existing needs, it should be flexible enough to fulfill many unexpected ones as well.

But it is not necessarily so simple. In many organizations, personal computers create and fill completely new needs that were not originally anticipated. Consider the example of a personal computer acquired to improve one lay worker's access to a main computer facility. While retrieving data from the main computer to run programs locally, this user finds that the personal computer can help evaluate alternative business strategies, answering "what—if . . .?" questions instantaneously. The original application for which the personal computer was purchased becomes secondary.

Given that the uses and benefits of personal computers are hard to predict, and that a wide range of systems and software are available, how should a potential buyer decide what and when to buy? And should such a buyer postpone action, expecting costs to decline in the future as they have in the past?

There are two arguments against postponing purchase in anticipation of a lower future price. One is the high cost of waiting, based on the computer's great (and often unexpected) uses. The other is that prices are expected to decline less dramatically in the future than in the past: future systems will offer technological improvements that increase performance at unchanged cost. Prices seem likely to stabilize at around $1,500 for a full personal-computer system.

Future personal computers are likely to offer increased memory size, increased processor power (16-bit and even 32-bit instead of 8-bit microprocessors), improved printers, more powerful programming languages that give the user more compact and natural communication with the computer, improved user access (better keyboards supplemented or replaced by touch screen and voice systems), and greater flexibility (the computer will be able to intermix and manipulate text, numbers, and graphics more easily).

Yet today's personal computers may rapidly become obsolete, reflecting the rapid pace of change in semiconductor technology. Changes in the microprocessor, the heart of any personal computer system, are most likely—and most serious. A computer with a 16-bit microprocessor cannot operate on hardware and software designed for an 8-bit microprocessor. Though many vendors provide add-ons that enable a new microprocessor to support old software, there is never total compatibility.

Software for a personal computer is expensive, and for most users new software development is impractical. So the amount and utility of the software available with a particular system is the key question in the buyer's choice of a personal computer. The variation can be large: 11,000 programs are available for the Apple II and Apple II Plus computers, whereas fewer than 100 widely distributed programs exist for the IBM personal computer, a more recent introduction. Of course, the IBM programs may be just the ones the buyer needs, and more software will be developed for the IBM.

Price is also an important variable, including not only the manufacturer's suggested price but the range of discounts offered by different retail computer sources. But discount alone does not tell the story. The critical factor is the ability of the distributor to provide both routine hardware maintenance, usually at the retail outlet, and software support and maintenance. A company store is likely to offer very good service on that company's product line but not necessarily on any other line, while a retail computer store is likely to offer moderately qualified service and support for many different manufacturers' systems. Mail-order sales offer very little service but usually have the highest discounts.

### System Configuration: How to Choose

The ultimate question for the purchaser is that of system configuration: What combination of hardware and software is appropriate for a buyer's current and projected needs?

Perhaps the most important options are off-the-shelf software. To be sure they buy what they need, buyers should gain some experience with available programs before making the purchase. Otherwise they risk having to modify their needs to fit the software they've purchased or embarking on the costly and time-consuming route of software development. The programming tools on most personal computers are primitive compared to the equivalents available for mainframes and the widespread dearth of good programmers is a complicating factor. Indeed, trying to develop special programming for a personal computer is inadvisable except under extraordinary circumstances.

Memory capacity is another important variable. Most computers based on 8-bit microprocessors have no more than 48 or 64 kilobytes of built-in accessible memory (RAM), while the newer 16-bit processors can have 1, 4, or even 16 megabytes. (One byte is a string

A personal computer's unique advantages should be used as a complement to the routine assignments of older mainframes.

**The next step in miniaturization. This "read-only" memory (ROM) chip, much smaller than a human hand, was made using a computer-controlled electron-beam tool. Units such as this will provide the much larger memories expected in personal computers within two years.**

of 8 binary digits that represents one alphabetic character.) Additional memory can be inserted into most personal computers by plugging cards into slots or inserting extra chips directly onto the microprocessor board.

Storage capacity of the main memory for programs and instructions can also be supplemented by secondary devices, of which floppy disks are the most popular form. Disks with capacities ranging from 100,000 bytes to several megabytes now come in two standard sizes: 8 inches and 5 1/4 inches in diameter. But personal-computer buyers should be aware that disks designed for one system will not generally operate in another maker's system because of different data-formatting conventions.

The critical performance characteristic of a floppy disk is the response time to a read-write request, which may range from 200 to 500 milliseconds. Though the response time for such a single file request is very short, a single compilation or word-processing command may involve 20 or more accesses to a floppy disk, and access time may account for 80 percent of the total command execution time. Where better performance and/or capacity are required, "hard" disks in the same format as the 5¼-inch and 8-inch floppy disks are useful. They offer storage capacities ranging from 5 to 50 megabytes and response time averaging 20 to 40 milliseconds, but their high cost (around $2,000, including interfaces) can double a buyer's total investment in hardware.

All personal-computer systems use cathode-ray tubes as output devices. If "hard copy" is required, buyers have a choice of several printing devices. Thermal printers, costing under $500, create images by applying points of heat to special paper. A dot-matrix printer, costing from $500 to $1,500, has a vertical array of 7 to 10 dot-printing elements. These are activated by the computer as the printing head passes across the paper, forming alphanumeric characters and also graphs and drawings. The limited number of elements results in a somewhat stylized character, but the process is as fast as thermal printing—50 characters per second. If letter-quality printing is required, a printing mechanism with precisely machined character matrices that strike the paper through a ribbon is required. Such printers cost $750 or more and print between 30 and 90 characters per second.

Various accessories such as floppy disks and printers—or "peripherals"—are attached to personal computers through special "slot" receptacles. The IBM personal computer offers five such slots for peripherals such as printer, color display, dual floppy-disk controller, communications channel, and memory module.

All business-oriented personal computers offer text editing for word processing. Some permit use of a light pen to directly indicate on the screen the word to be edited, and a few check spelling against a mini-dictionary stored in the computer memory. Business data manipulation is facilitated by "spreadsheet" packages such as VISICALC—a very popular package that enables users to see on the CRT the impact of altering one figure (say, retail price) on all other figures (profit margin, corporate profit, return on investment). Software is now becoming available for generating displays such as those accompanying this article with only a few minutes' effort. For example, ExecuVision permits displays combining information in numbers, text, and pictures. It also provides animation that can add emphasis to presentations.

Though personal computers are today viewed primarily as stand-alone work stations for individual users, the ability to transmit and receive data and programs is an important attribute of most contemporary systems. Personal computers are already serving as intelligent terminals for retrieving and manipulating files from large computers. These networking and communication capabilities are important considerations in selecting a personal computer. Unfortunately, no industry standard for communication protocols and interfaces exists. Different vendors use different protocols, so it is difficult to link various personal computers in a single network.

### Playing Games and Buying Stocks

Technological advances in communications are expanding the power of personal computers. For example, owners of personal computers can now re-

PHOTOGRAPH: IBM

# Personal Computers from Japan?

THE Japanese are gearing up to do in the U.S. market for personal computers what they have done so successfully in steel, automobiles, and stereos.

Already the Japanese government is playing a significant role in developing that nation's computer industry by providing direct subsidies to computer manufacturers. These come in three forms: support for cooperative research and development, loan guarantees through the Bank of Japan for major capital projects, and favorable tariff protection. In addition, a government-sponsored organization, the Japan Electronic Computer Corp., provides advantageous arrangements for leasing computers to stimulate the domestic market, which in turn increases the export potential.

Over 40 models of Japanese personal computers are available. The Japanese dominate their domestic market with personal computers of high quality (the principal producers are OKI, Fujitsu, Mitsubishi, NEC, Toshiba, and Hitachi). But the Japanese have so far captured very little of the U.S. personal computer market because they are still weak in software, marketing, and distribution.

The Japanese have begun a five-year effort to remedy their weakness in user-friendly languages, operating systems, and interfaces. Pending completion of this work, they are adopting the most common operating systems offered in the United States.

Several approaches are being taken to solve the marketing and distribution problems. One is to contract with U.S. distributors to create marketing agencies such as TRW/Fujitsu. Another approach, typified by NEC, is to market personal-computer products directly at the retail level. A third approach is to use existing retail channels in which there is already a strong Japanese presence, such as stereo and hi-fi outlets, department stores, and specialty electronic stores.

Current Japanese personal computers released in the United States use 8-bit processors and off-the-shelf operating systems, giving them capabilities characteristic of the lower-priced portable personal computers made in the United States. As software and distribution problems are solved, these personal computers, priced at under $1,000, will provide strong competition to such U.S.-made units as Osborne and Sinclair/Timex. Indeed, the Japanese capacity for high volumes, high quality, and mass distribution suggests that their products will soon dominate the U.S. market for portable and basic desk-top machines. In response, U.S. companies such as Apple and Radio Shack are now expanding their product lines to include more sophisticated desk-top computers.

Dominance of the low end of the personal computer market, if achieved, will provide a base from which Japanese manufacturers will be able to attack the medium-and high-priced segments of the U.S. personal computer market.

*H.-M.D.T. and A.G.* □

ceive current stock-market quotations by telephone. Personal computers can be connected with nationwide electronic-funds-transfer systems, so users have access to full banking facilities. They may transfer funds from one account to another and buy and sell financial instruments.

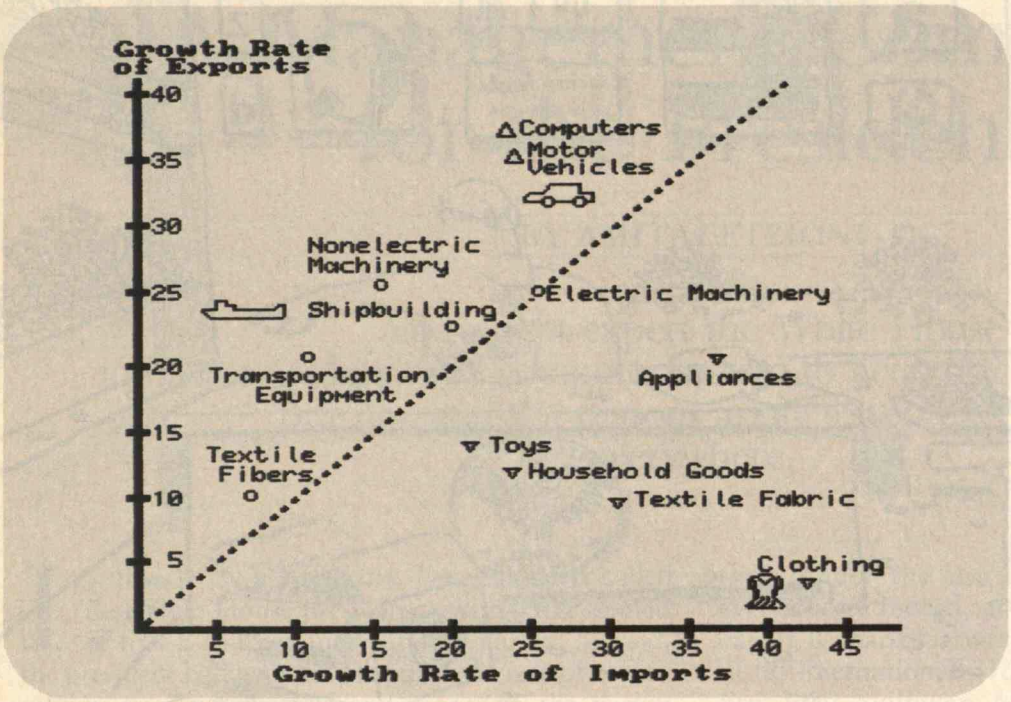
In homes, personal computers are now primarily used for recreational activities such as computer games. But these applications should not be underrated. Computer games test and develop mental capabilities while generating familiarity with computer operations.

Home computers are also used for office work at home, and many other applications are—or soon will be—possible. For example, a tax return can be prepared with the aid of VISICALC, an "electronic worksheet" program that is the most popular single software package for personal computers. The user can analyze which forms and deductions to use for paying the minimum taxes. A personal computer can be used to balance checkbooks and plan investment strategies. And, of course, word-processing capabilities are useful in writing letters and professional papers. As commercial databases such as Dow Jones News Retrieval and the Source are expanded and their subscription costs reduced, personal computers will be useful for locating stores and services, comparing prices, and placing orders. This would be especially appropriate for products or services whose prices fluctuate rapidly, such as those of the airline industry.

Computers are being used increasingly for security applications. Traditional home-security sytems are limited, often failing to distinguish between a natural event and an intrusion by an unwanted visitor. Computer-controlled home-security systems can include a variety of routines to analyze the signals from sensors before generating an alarm. Such an analysis can distinguish, for example, between the entry of a cat and the entry of a human being, or between the noise of a telephone ringing and a door opening.

Another home-oriented application is a medical-information system that performs some of the diagnostics of a medical doctor. Perhaps the most useful application of this is a database for poison or first-aid: the user reports what substance the patient has ingested or the nature of an accident, and the computer responds with a step-by-step first-aid plan.

Children turn out to be heavy users of home computers. They enjoy computer games and seem able to learn computer languages faster than their elders. They find personal computers intriguing for recrea-




**Rating the export potential of Japanese industrial sectors. To identify the best potential performers, look to the top and left—at those sectors of Japanese industry in which the growth rates of exported Japanese-made products are high compared with the growth rates of imported goods. The star performers are motor vehicles and computers, in which Japan's domestic growth has been high and its import growth low. The poorest potential performers are toys, household goods, fabric, and clothing, all sectors in which Japanese imports are growing faster than exports.**

tion, school assignments, and self-paced courses that are now becoming available.

## High Power in a New Mode

Even though today's personal computers are equivalent in basic computing power to the mainframes of the 1960s and the minicomputers of the 1970s, they should not be used as substitutes for the earlier machines. Rather, users should capitalize on the new technical developments, including the diminishing cost of computing, and the Englishlike languages that replace the cumbersome digital languages of early machines, to make personal computers supplement, not displace, mainframe computers. Personal computers should be used to analyze more issues in greater detail than ever before—not to do the more routine work typically assigned to mainframes.

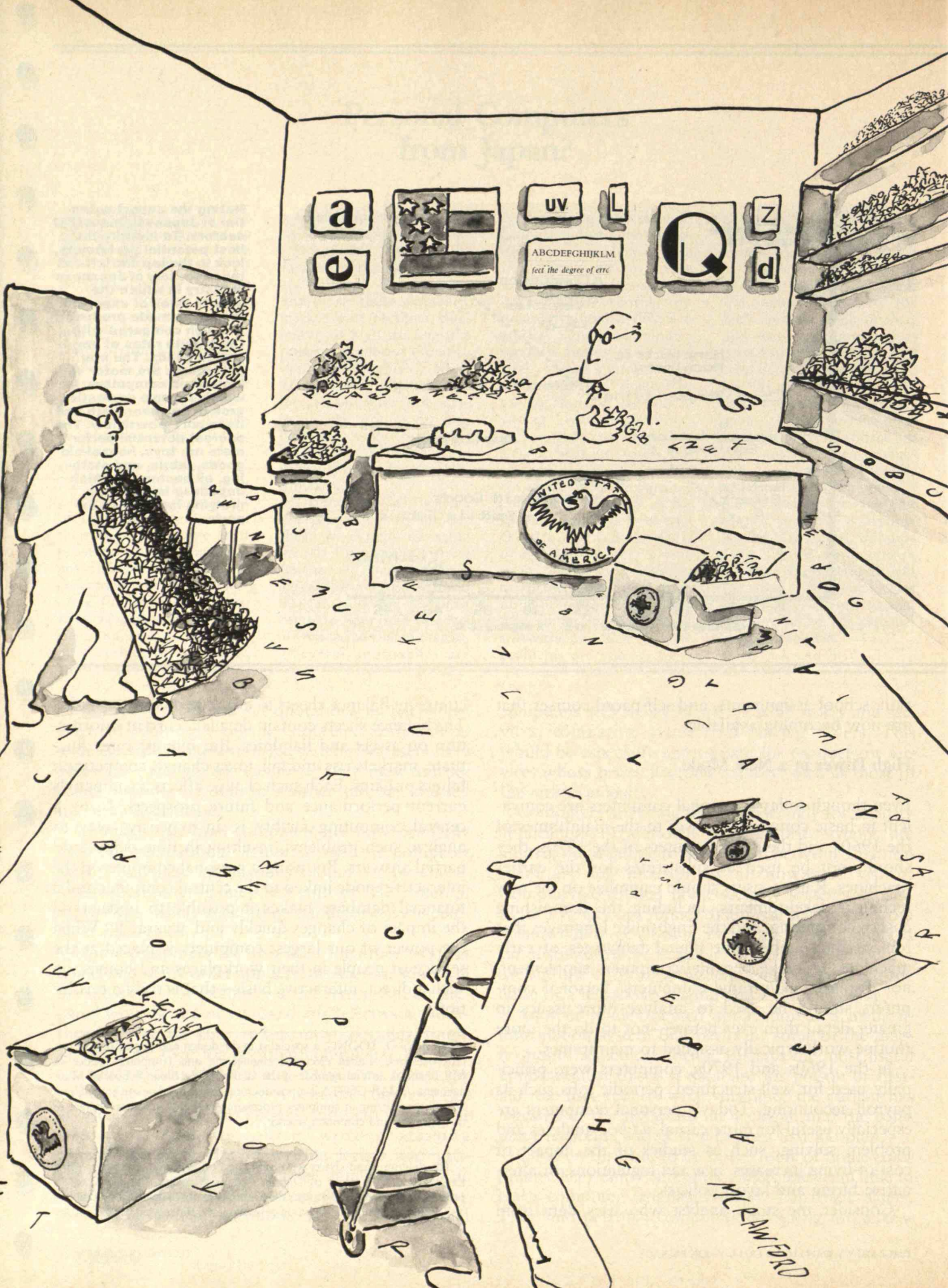
In the 1960s and 1970s, computers were principally used for well-structured, periodic jobs such as payroll accounting. Today's personal computers are especially useful for more casual, *ad hoc* analyses and problem solving, such as studies of the impact of cost-of-living increases, new tax regulations, or alternative hiring and layoff policies.

Consider the stock analyst who uses data from company balance sheets to evaluate investment risks. The balance sheets contain detailed, current information on assets and liabilities. But interest rates fluctuate, markets rise and fall, taxes change, competition falters or gains. Each such change affects a company's current performance and future prospects. Using a central computing facility is an expensive way to analyze such problems, resulting in time delays and partial answers. But using a personal computer in the interactive mode linked to the central computer and a financial database makes it possible to understand the impact of changes quickly and accurately. When the power of our largest computers is placed at the service of people in their workplaces and homes, on such a direct, interactive basis—that is truly a revolution.

HOO-MIN D. TOONG, a specialist in the design and application of microprocessors, studied electrical engineering and computer science at M.I.T. and is now a member of the faculty of the Sloan School of Management. AMAR GUPTA is a postdoctoral research associate in the Sloan School specializing in computer processing; he holds graduate degrees in management and computer science.

The diagrams and charts were generated on personal computers using ExecuVision, a product of Digital Systems Associates, and Visiplot, a product marketed by Visicorp.; the authors acknowledge the assistance of Y-Y Wang and Poonam Gupta in generating the slides using ExecuVision.

DIAGRAM: Y-Y WANG USING EXECU-VISION PACKAGE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# A Management Computer for the President

BY AMITAI ETZIONI

**You might expect the White House to have a sophisticated computer system to keep track of its activities. But no—and the reasons apply to top executives everywhere.**

In July 1979, a *New York Times* reporter called the White House press office with what seemed at first a routine query. A year earlier, he said, the president had promised to study the role of coal in solving our energy crisis and report to the nation within 30 days. (President Carter was fond of setting such deadlines for himself and his staff.) The reporter wanted to know what had happened to the promised study. The press officer did not know. He called around to other White House agencies, to no avail. He checked with the Department of Energy, but no one could recall the president's charging the department with such a task. Eventually, much too late to help the embarrassed press officer, it was established that the Interior Department was working—still working—on the study.

This incident was only one of many that helped foster a sense of lack of presidential follow-through. (Indeed, this is a problem by no means limited to one administration.) It also underscored the fact that the president had no routine procedure to keep track of what he assigned people and agencies to do, no expected completion dates, no list to show who is accountable, no systematic follow-up to establish who is behind schedule. In short, the president did not have a comprehensive management tracking system at his fingertips.

To remedy this situation, an attempt was made to use a computer to provide such a tracking system. I participated as an adviser—and I saw the efforts derailed by serious technical and political problems. These problems deserve attention not only because they limit the president's effectiveness but because they hinder the use of computers by managers everywhere. Indeed, at one point I asked computer expert Richard Garwin of IBM if the top executives of his internationally renowned computer-producing firm used computers for management tracking. His answer was very brief: no.

One major difficulty in providing the president with a proper tracking system was the issue of what constitutes a presidential directive. For instance, if during a speech the president reassures a group of American exporters that he has every intention of helping them increase exports next year, and that he will seek to open 20 new trade offices overseas for that purpose, does this constitute a directive? To whom? Should a management tracking system encompass only those matters the president orders personally—or also the many other instructions issued in his name by the presidentially appointed White House staff?

Top business executives face a similar problem, albeit on a different scale. They, too, deal with the outside world. For example, announcing that the corporation will do what it can, with all deliberate speed, to hire and promote more minorities and women may "buy" the corporation or its head some time and political points. Not to put those intentions into the tracking system may make the statement into an open lie, signaling that no implementation is expected. Putting them into the tracking system literally may trigger much more action than desired. Politics thrives on ambiguities; computers on ferreting them out and rejecting them.

There was also a highly charged authority and "ac-

ILLUSTRATIONS: MICHAEL CRAWFORD

They neglected two matters that all compilers of information must face: the level of reality and the level of abstraction.

cess" issue: who would be in charge of such a White House tracking system? Note that this person would in effect oversee the performance of all the president's men, women, and agencies. Even what seemed like a minor question—where to place the computer—turned out to be tricky. In the White House? It would smack of 1984. Outside? Where? (In corporations this issue will take the form of asking if computers should be a staff service or a headquarters function, and will "the" computer be open to direct access by managers of local plants and subsidiaries?)

### A Many Splintered Thing

Most people who refer to "the White House" think about it as composed of the president and his staff. Actually it is organized into divisions, each with its own head, surprisingly strong divisional loyalties, and considerable infighting. The names and duties of the divisions change from administration to administration but not the basic organization. In the Carter White House, a little noted division was the Office of Administration, which took care of running the place internally, from writing checks to printing the president's speeches. It also managed a library and a research staff responding to questions from other divisions. The head of the Office of Administration, who also served as special assistant to the president for information (information flowing into the White House, not the other way), was a Georgian named Richard M. Harden. He retained me as "senior adviser," occasionally drew upon my counsel, and frequently offered it to other divisions. Developing a management tracking system was one more service the Office of Administration was going to render to the White House.

From the start, another matter familiar to politics deeply affected the way that the tracking system did *not* get underway. By mid-1979, the election loomed on the horizon and there was a growing demand for a list of the achievements of the administration. This was a more delicate matter than it might first seem. By law, public funds and resources cannot be used for election purposes, and this prohibition encompasses the White House staff. Indeed, people who openly worked on the reelection campaign had to be "Hatched"—removed from the public payroll under the provisions of the Hatch Act—and moved to Democratic Party headquarters. Nevertheless, the Carter administration, like others, tried within the limits of the law to stretch matters a bit, to use the White House staff for activities that might be in the public service as well as useful for the campaign. The assignment of compiling what the president had done was a case in point.

Twelve young persons, some regular White House staffers and some interns—all "politically reliable"—had been brought together under the stewardship of Earl Bender. They worked in the Old Executive Office Building, located next to the White House, and on my first day of work I visited the group. Having had some 20 years of experience in collecting and processing data, I was taken aback by the complete inexperience of the crew and its leader. Bender was an excellent campaign worker, with a keen sense for partisan politics and precinct organization, but he had little knowledge of the problems of data processing. The rest of the staff was less qualified. What the staff was doing was listing next to each other highly divergent items. These included statements culled from presidential speeches, legislation sent to Congress but not necessarily enacted, actual accomplishments, some steps undertaken by the White House staff under the president's directives, and some steps by various federal agencies on the initiative of their heads.

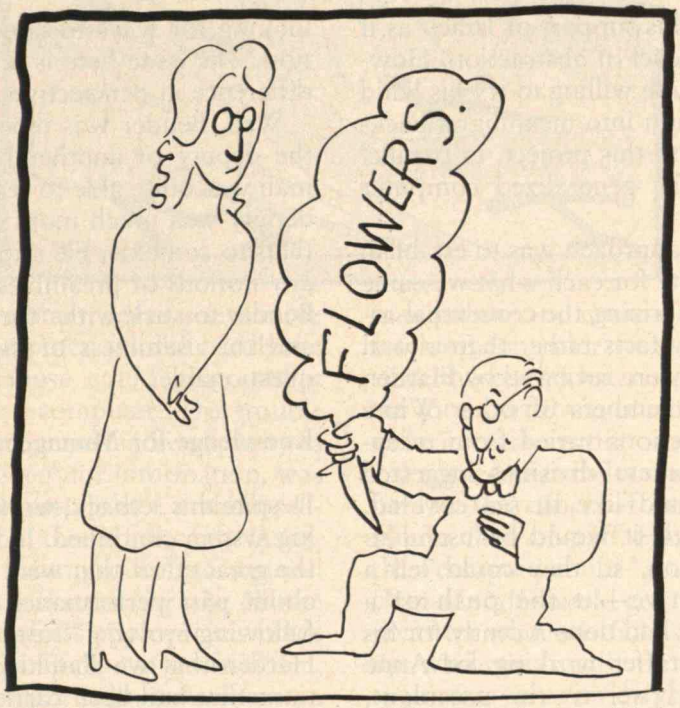
Even a brief review of the lists the group churned out showed clearly that the potpourri they were blending neglected any consideration of two matters that all compilers of information, political or otherwise, must face—the level of reality and the level of abstraction. The level of reality concerns the difficult transition from expression of goodwill and intention to actual performance, a problem familiar to anyone who ever decided to stop smoking or lose weight. It is of course much more complicated in the White House, since promises, gestures of support, and threats play as large a role in politics as actual performances. Also, to list only accomplishments, Bender said rather wryly, would not make a very long or compelling list. So "everything" was included, except some steps taken by agencies—especially the Department of Health, Education, and Welfare under Secretary Joseph Califano—that were clearly incompatible with White House policy.

### Information Without Knowledge

The second matter the group overlooked, the level of abstraction, is an even greater issue. I had faced it

Facts are often not usable by themselves: the context is the source of their meaning.

through much of my career as I tried to develop a social-science theory of social change. When attempts are made to engineer social change, one of the factors that determines success is the amount and quality of the knowledge available about the nature of the problem and possible correctives. But before one can determine the amount and quality of the knowledge involved, one must decide what constitutes knowledge as distinct from information.




Most people tend to think of knowledge as a compilation of facts, somewhat like a telephone directory, with one bit of information listed next to another, ready to be used. However, such bits of data are often not usable by themselves. For one thing, their meaning—unlike information in the phone book—cannot be established without understanding the context in which these bits exist. The context contains the assumptions implicit in the facts and is the source of their meaning. To provide a simplistic example, the information that the temperature is 30 degrees tells us nothing unless it is specified whether it is Fahrenheit or Celsius, which defines the scale on which the point 30 finds its meaning. Human knowledge in general and science in particular are crisscrossed with such contextual assumptions, only the contexts in which the bits find their definitions and their meaning are much more complicated, richer, and more consequential. Thus, for example, the same national statistics will lead a Keynesian economist to rather different conclusions from those who subscribe to supply-side economics. Keynesian or supply-side theory provides the context.

Another limit on the value of bits of data is that no single observation is usable in isolation. Knowledge is gained by collecting a variety of observations, often partially incompatible, and synthesizing them into conclusions based in part on the observations themselves, in part on past observations, and in part on the logic of argumentation. This process of knowledge-building often leads one to play down some observations and play up others. Without it, isolated facts are misleading rather than informative.

I cannot stress enough that, as I see it, not only does science work like this, but also all kinds of knowing. For instance, in evaluating a presidential candidate or deciding whether to join or leave a political party, citizens cannot and do not relate to thousands of facts—that they like the candidate's policy on El Salvador but not his national security adviser, they favor his position on American fishing rights but not on the law of the seas, and so on. They tend instead to form a limited number of contexts, in part on the basis of general predispositions and in part on the basis of specific observations. For example, they may form an economic context, one on foreign affairs, and a general impression of personal competence.

Regarding the economy, for instance, citizens may feel that their first concern is to fight inflation, second to compete overseas, third to keep jobs. In this context, the Consumer Price Index (however misleading) becomes of paramount importance, unemployment data less so. Many other facts, such as decline in labor mobility, are either meaningless "bits without a home," or gain meaning once they are related to one of the core of contextual assumptions. (For example, reduced labor mobility may be seen as bad for economic strength and hence international competition.)

**Institutionalized Incapacity**

Armed with this understanding of how knowledge is formed, I was convinced that the telephone-directory approach worked out by Bender and company would be of no avail. They were listing items, some sheer facts (for example, the president appointed $x$ women judges and $y$ black judges), and some contexts (the

The question of how many terminals the White House would need, and who would have access to them, opened up the issue of power.

president has been firm in his support of Israel) as if they were all of the same level of abstraction. However, Bender said he was quite willing to try his hand at integrating the information into meaningful packages. So I began working on this project, in parallel with efforts to develop the generalized computer tracking system.

We figured that the best approach was to establish a small list of contexts, write for each what we came to call a "preamble" summarizing the contextual assumptions, followed by *key* facts rather than a total list. Samples of our efforts were reviewed by Harden and, informally, by staff members of other White House divisions. Their reactions varied from receptive to enthusiastic. Soon, several divisions suggested additional facets they would like to see covered. "Congressional Liaison" felt it would be useful to have geographic information, so they could tell a congressional representative—at the push of a button—what the president had done recently for his or her district. A young staffer working for Anne Wexler, chief political adviser to the president, suggested listing also the main interest groups that support or oppose measures being promoted by the White House, to help in lobbying efforts.

Things seemed to be going well, but then we ran into institutionalized incapacity. This problem was identified years ago by sociologist Thorstein Veblen, who pointed out that a specialist often does not see what any straight-thinking person can; the specialized mind, honed in one direction, acquires an inability to perceive matters that are strung in a different direction. Above all, specialists of different disciplines find it difficult to communicate with each other because of the implicit contextual differences among disciplines. Thus, for instance, when scientists testified before a congressional committee that they thought there was a very high probability that a test ban on nuclear weapons could be effectively enforced without on-site inspections (to which the Soviet Union vehemently objected), they felt that they had made a strong statement in favor of the ban. Scientists tend to think in probabilities and recognize practically no absolutes; "very high probability" is about as certain as things ever get. In contrast, many politicians are by training lawyers: if they find loopholes, this spells trouble. Thus, the scientists' statement about the test-ban treaty suggested to members of the congressional committee that it had enough loopholes to make it unreliable and sent them looking for ways to close every one before ratification. The issue here is not who was "right" but the difference in perspectives.

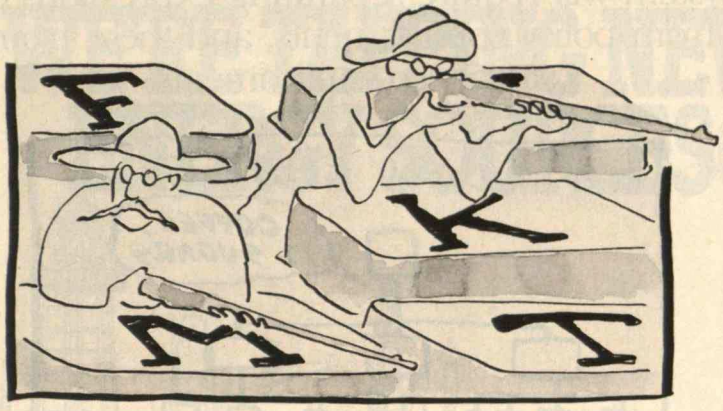
Well, Bender was reporting to a lawyer who was the deputy of another lawyer, and while the head man was quite able to see the forest for the trees, the deputy was much more committed to the fine print than to contexts. He strongly and repeatedly vetoed any notions of preambles or contexts and instructed Bender to stick with "the facts." This the group did, and the usefulness of its efforts turned out at best questionable.

### Knowledge for Management

Despite this setback, work on the management tracking system continued. Indeed, it occurred to me that the great effort that went into collecting information about past performance could serve as a basis for following evolving "future" events. So I suggested to Harden that we should put into a computer all actions that had been carried out by the White House and the agencies, organized in contexts according to subject areas (such as energy, health, education) and subareas (solar, nuclear, coal). This would include a list of the people accountable and, in the case of ongoing projects, the expected completion dates. We could then update the system daily as new presidential directives were issued, thus providing a detailed progress report on White House activities. But it didn't quite work out quite that easily.

The first thing Harden and I found was that the White House did not have an appropriate computer and feared having one. This statement requires some elucidation. While the White House had several computers, these were deliberately either small or specialized. The Secret Service had one, but strictly for its own purposes (such as keeping track of all visitors). Hugh A. Carter, special assistant to the president for administration, also known as "Cousin Hugh," had one, but it served mainly for housekeeping purposes. The Office of Management and Budget and the National Security Council each had their own. But none of these was suitable to, or available for, general management tracking purposes. Moreover, the very idea of creating a central computerized system to shadow the work of all the government agencies smacked too much of Big Brother. "What will the press say?" was a rhetorical question often raised. And the fact that feeding and updating

Resistance to central management, reflecting the White House power bases, kept computerized tracking from taking off.



such a system would require additional staff practically ruled it out; the White House was under continued pressure to be small and seem small.

But a solution was eventually proposed—hide the computer in the military. Here a few more staffers and one more computer would hardly be noticed, and the White House could plug into it without actually "having" a computer. The trouble with this idea, as Harden recognized in his capacity as special assistant to the president for information, was that he could not simply request John Carabello, director for data automation in the Office of the Assistant Secretary of Defense (Comptroller), to squirrel away a management data system for the White House. This is not what Congress appropriates funds to the Pentagon for, and Carabello—a professional, not a political appointee—might balk; indeed, even a political aide might ask for instruction in writing. Instead, Harden drafted a brief note which Hamilton Jordan, Carter's chief of staff, sent to Harold Brown, secretary of defense. (If not exactly illegal, this maneuver represented a direct attempt to use funds in a way not authorized by Congress.) Shown a copy of this note, Carabello was willing to work with us, although his conversion to full support came later, during a meeting in the Pentagon itself.

### Questions of Access

Carabello saw no particular technical difficulties in setting up the system, although he was worried about the costs, especially the question of staffing it on a continuous basis, and what account to charge for the expenses involved. However, his attitude turned from dutifully cooperative to openly enthusiastic when the issue of terminals came up. The matter arose almost casually as we discussed the details of the system: To "access" the system, we were asked, how many terminals will the White House need? This seemingly simple question opened up the issue of power. Students of the effects of computerization on organizational hierarchies have often pointed out that introducing computers affects the power structure of an organization. Exactly what the effects are is less clear, but there always seem to be some. For instance, computers make it easier for people of various ranks to access a body of information that in pre-computer days was more closely held. These studies have usually dealt with computers used largely to store, manipulate, and retrieve information. A management tracking computer would have even greater impact, since those who had access to it could gain a view of the total performance of any division—theirs or a rival's, even the entire organization's.

I argued that the computer should have one terminal, in the office of Hamilton Jordan, the White House chief of staff. Harden's people, backed up by the Pentagon, could "staff" the service, but only the chief of staff should get the daily or weekly status reports on who was falling behind, who needed backup, who was usually on target. If the computer were to provide an overview, its most appropriate first user would be the chief, who could distribute the information as he deemed fit.

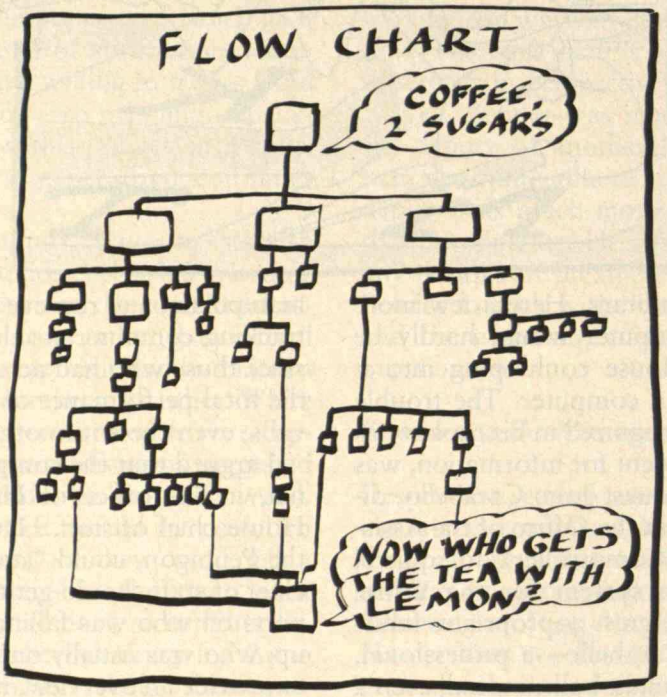
Harden, on the other hand, maintained that there should be scores of terminals within the White House and at least one in each federal agency. He believed dispersal throughout the White House was needed to reduce any sense of threat to other divisions if one division, Harden's, was to manage the information to be fed into the computer and thus in effect become part of the supervisory system. (As Harden saw it, "Anyone who gets ahead of the pack will be eaten up by it.") Also, he believed all the White House divisions could benefit from the information, and of course they would have to feed their performances into the computer to keep it up to date. Moreover, he felt the same way about the government agencies, which I thought did not wish to be closely supervised by the White House and would not be willing to link into such a system. When we visited the Department of Housing and Urban Development, as a trial run, we were told flatly: "We would be happy to join your system as long as our internal agency tracking system could not be accessed from the White House."

What delighted Carabello in all that? As Carabello saw it, the White House was in a "mess," with various divisions each pulling its own way. Working within the military, he was deeply offended by all these squabbles. He seemed to see a great mission to

Introducing a management tracking system will require separating expressions of goodwill from policy commitments, and these from actual accomplishments.

"straighten out the mess" once and for all—via the computer system. It would provide a central focal point for more streamlined management, which "by golly, the place needed."

Resistance to just such central management, reflecting the plurality of viewpoints and power bases within the White House, was what finally prevented computerized tracking from taking off. During this period, Alonzo L. McDonald was appointed to work directly with Jordan on White House matters, and he brought his own ideas of how to proceed with such a system. Hugh Carter did not like Harden's getting more duties and power, and the other divisions seemed to be increasingly suspicious of the whole thing. And, as the support for the tracking system was weak and growing weaker, it was easy to become preoccupied with other matters. Soon, meetings on the tracking system grew less frequent, and staff was gradually assigned elsewhere. The idea seemed to fade away without ever being tested on the White House level. (However, the Reagan administration is reported to be working on one.)




### Success—in a Subsystem

Meanwhile, there was an unintended dry run of the tracking system, or at least a fair facsimile of it, in one segment of the White House. The Carter administration's first legislative package on energy, launched in 1977, did not get very far in Congress. On July 15, 1979, after a dramatic review of his general policies, Carter returned from Camp David and addressed the nation, proclaiming that America suffered from a decay of the spirit and that our attempt to come to terms with the energy crisis was to be a measure of our spiritual revival. In the months that followed, the White House pulled out all stops to get the new energy package going. A task force was set up within the White House, with 15 subgroups but with one purpose: to manage the legislative and political drive and the public "outreach" (that is, modification of public opinion) to get the energy package through. The subgroups covered specific topics and their focus cut across federal agencies, congressional committees, and interest groups. They included "solar bank," "energy mobilization board," "windfall profits tax," "Alaskan gas pipeline," among others. While this drive may not have provided a fair test of the American spirit, it surely came to be seen as a test of the administration's ability to get its act together.

Harden and I talked to key staff members on the task force about the advantages of using a computerized system to track and coordinate the scores of efforts that the various subgroups were undertaking simultaneously. Soon a minicomputer and printer were rolled into the New Executive Office Building where the staff was headquartered. Daily, at about 3 P.M., information from all the subgroups was fed into the computer—achievements, benchmarks for next steps ("to do list" and "due dates"), and synergistic acts that required two or more subgroups to coordinate their efforts or required one to wait until another moved. (For instance, a subgroup might have to clear a step to be publicized with the appropriate congressional committees; members of Congress resent reading in the press matters which concern them and about which they were not previously informed.) By 8 A.M. the next day a classified copy of the resulting book was on the desk of each task force member. The system did not perform any miracles—in terms of spiritual restoration or increased energy supplies—but it contributed handsomely to the managerial effectiveness of this drive.

Admittedly, several factors made the use of a computerized management tracking system easier for the energy task force than for the White House as a

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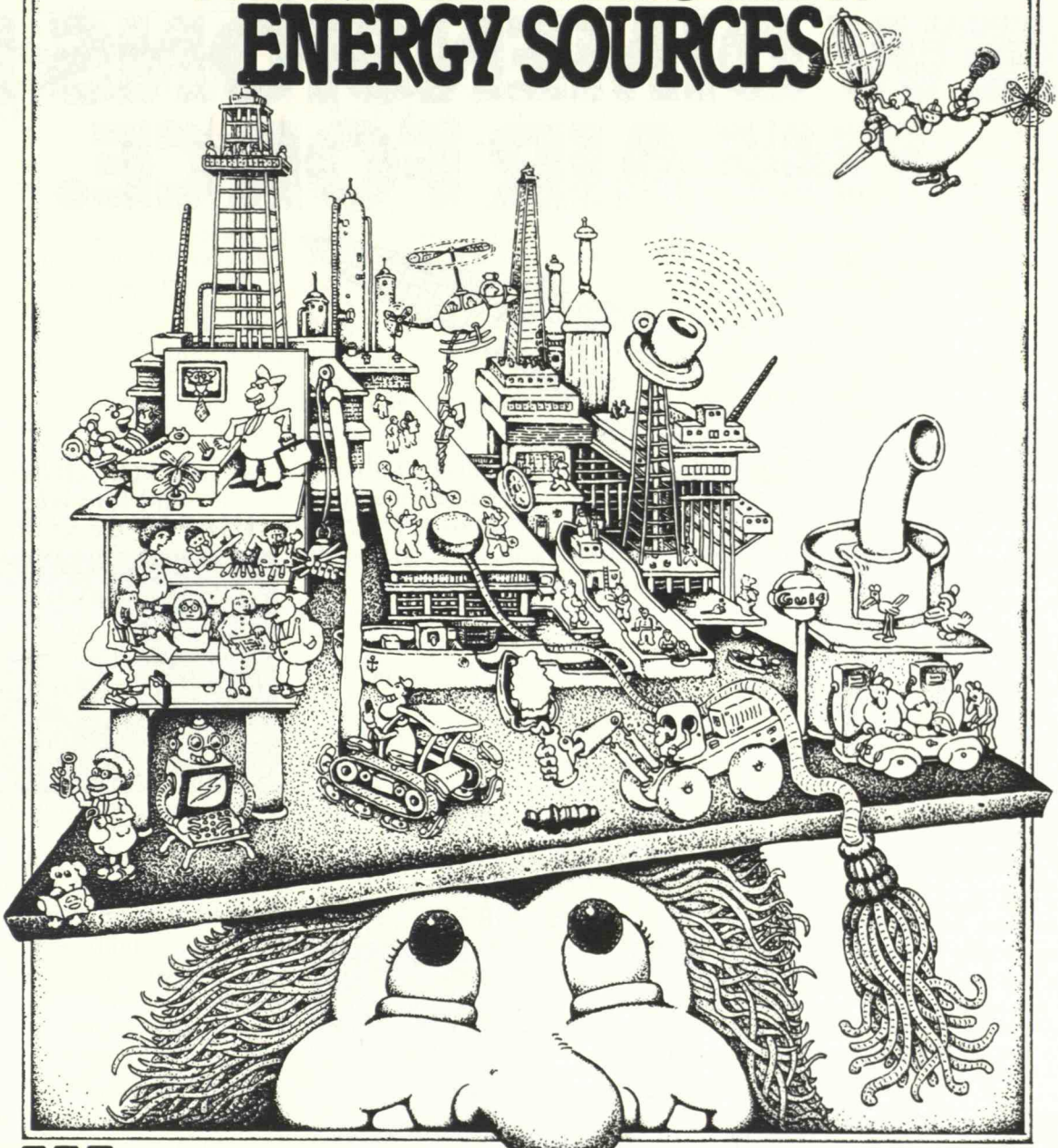

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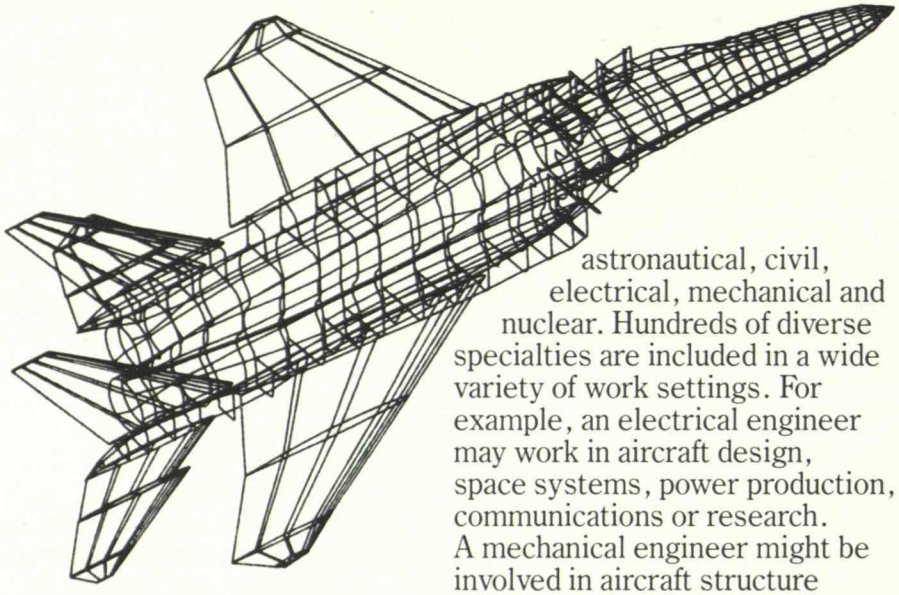
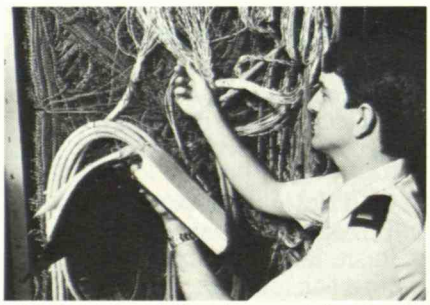
# ENGINEERING TAKES ON EXCITING NEW DIMENSIONS IN THE AIR FORCE.



Computer-generated design for investigating structural strengths and weaknesses.

Developing and managing Air Force engineering projects could be the most important, exciting challenge of your life. The projects extend to virtually every engineering frontier.

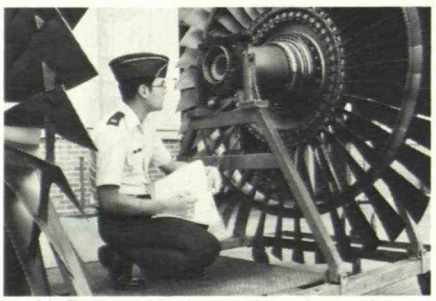
## 8 CAREER FIELDS FOR ENGINEERS



Air Force electrical engineer studying aircraft electrical power supply system.

Engineering opportunities in the Air Force include these eight career areas: aeronautical, aerospace, architectural, astronautical, civil, electrical, mechanical and nuclear. Hundreds of diverse specialties are included in a wide variety of work settings. For example, an electrical engineer may work in aircraft design, space systems, power production, communications or research. A mechanical engineer might be involved in aircraft structure design, space vehicle launch pad construction, or research.

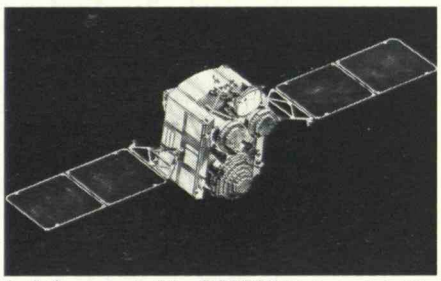
## PROJECT RESPONSIBILITY COMES EARLY IN THE AIR FORCE



Air Force mechanical engineer inspecting aircraft jet engine turbine.

Most Air Force engineers have complete project responsibility early in their careers. For example, a first lieutenant directed work on a new airborne electronic system to pinpoint radiating targets. Another engineer tested the jet engines for advanced tanker and cargo aircraft.

## OPPORTUNITIES IN THE NEW USAF SPACE COMMAND



Artist's concept of the DSCS III Defense Satellite Communications System satellite. (USAF photo.)

Recently, the Air Force formed a new Space Command. Its role is to pull together space operations and research and development efforts, focusing on the unique technological needs of space systems. This can be your opportunity to join the team that develops superior space systems as the Air Force moves into the twenty-first century.

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## Computers versus People: Regaining Control

No one has yet fought a battle to the death with a computer, the way the astronaut fought HAL in *2001*. But the people-computer conflict is very real, spawning frustration among computer users and discouraging would-be users from making the leap. Even the experts can have problems: Daniel McCracken, past president of the Association for Computing Machinery who's written 17 books on computers, recently spent 15 months and $841 trying to make his new home computer work for him.

A new attack on this widely noted problem has now been mounted by Professor Andrea diSessa and his colleagues at the M.I.T. Laboratory for Computer Science—with a new language called BOXER designed to make computers easier to use. It's "the only project around building a broad range of functions for people who don't want to be programmers," Professor diSessa says. Its the first effort to integrate all a computer's functions and use a single vocabulary to control them.

Most computer systems are divided into subsystems such as the editor, monitor, and compiler, each of which independently performs certain functions and responds to certain commands. New computer users complain that they cannot figure out which subsystem they're in and what commands to use there. The goal of BOXER is to replace all the subsystem commands with six function keys and graphically represent everything in the computer by a box. Text such as letters or messages from other computers is stored in boxes.

Boxes can be nested, allowing users to manipulate the computer's contents in whatever way they wish. Users can create commands (they need not memorize the predefined ones) by putting instructions in a labeled box and pressing a DO-IT key.

The system, says Professor diSessa, should make it easy for users to keep track of what the computer is doing. Programs seem to be located in a specific place, not hidden away somewhere in memory. When users erase a program, they see it disappear. Professor diSessa calls it *naive realism*. "If people are really going to be able to *use* computers, they have to feel that they're in control of what the machine is doing," he says.

But Professor Joseph Weizenbaum of M.I.T. warns that the effort to make computer systems less intimidating and easier to use is just beginning, and too much of it is superficial. "User-friendly" designs often fall short of the mark because they are concerned more with atmosphere than with substance. Making the computer say please and thank-you is a cosmetic fix that doesn't really increase the user's understanding of what's going on in the machine, he says. "Friendliness has a lot to do with real cooperation, not just linguistic decoration."

How to bring computers and people closer together, in addition to making basic program changes such as Professor diSessa's? Professor Weizenbaum thinks computer science students should be trained in the human and social aspects of computer design, to make the students more sensitive to the average user's plight. But that doesn't often happen. At M.I.T., students majoring in computer science can graduate without attending a single lecture about computers' effects on people.

But market forces may accomplish what education cannot. The industry is realizing that if home computers are to become as common as TV sets, they must be easier to use. Today's home computers cannot use languages such as BOXER because the language requires more memory, processing speed, and high-quality graphics than are now available on these machines. But Professor diSessa predicts that improvements will make BOXER and similar programs available on home computers in a few years.—*Heidi Picher Dempsey, '82* □

## Cold Winter Coming—Maybe

Sunspot activity is reaching a low ebb, and with it will come cold weather—extreme cold this winter, especially in the southeast, and for the next two or three winters as well.

Hurd C. Willett, emeritus professor of meteorology, is the originator and chief proponent of a theory that sunspot activity correlates with changes in climate and weather. Applying this theory to our present situation, Professor Willett proposes that November should be cold, December not quite so bad, and January and February really below normal—as much as eight degrees below normal in the Carolinas and nearly as cold in the rest of the east.

But Professor Willett admitted to Susan Stamberg of National Public Radio's "All Things Considered" that "we don't really understand why sunspots work that way, as past statistics suggest."

"Are you going someplace warm this winter?" Ms. Stamberg asked Dr. Willett. "Well, that depends on whether my forecast is right or not," he answered. □

## Forecasting: Oil Man's Nightmare

The world price of oil in 1990 will be between $27 and $50 a barrel (1980 dollars) if there is no crisis-spawned production lapse during this decade. If there's a single price-ratcheting "shock" such as that in 1973, the range for 1990 prices is $30 to $40 a barrel.

And if these forecasts seem less precise than you wish they were, join the club. Their results, say Professor Henry D. Jacoby and James L. Paddock of the M.I.T. Energy Laboratory, simply reflect the fact that the world oil market is "a forecaster's nightmare." Indeed, the most important thing about those figures to the economists, from whose computer they come, is not their amount but the range of uncertainty.

The figures result from a process of modeling on a computer many different scenarios for economic growth based on various estimates of oil demand, production, and price. The computer made many different forecasts of future combinations of oil prices and economic performance. Many of these seemed to Messrs. Jacoby and Paddock to be either impossible (because, for example, they showed oil markets failing to clear) or unlikely (for example, annual GNP growth sustained at 90 percent of 1980 levels despite oil prices rising at 5 percent a year.)

By weighing a host of such empirical forecasts, Professor Jacoby and Dr. Paddock constructed a window that excludes all their impossible and unlikely answers. The window shows oil prices between $27 and $50 and GNP growing at 1.7 to 2.5 percent a year. The size of that window, they say, "illustrates the futility—indeed the naivete—of point forecasts" of oil prices. □

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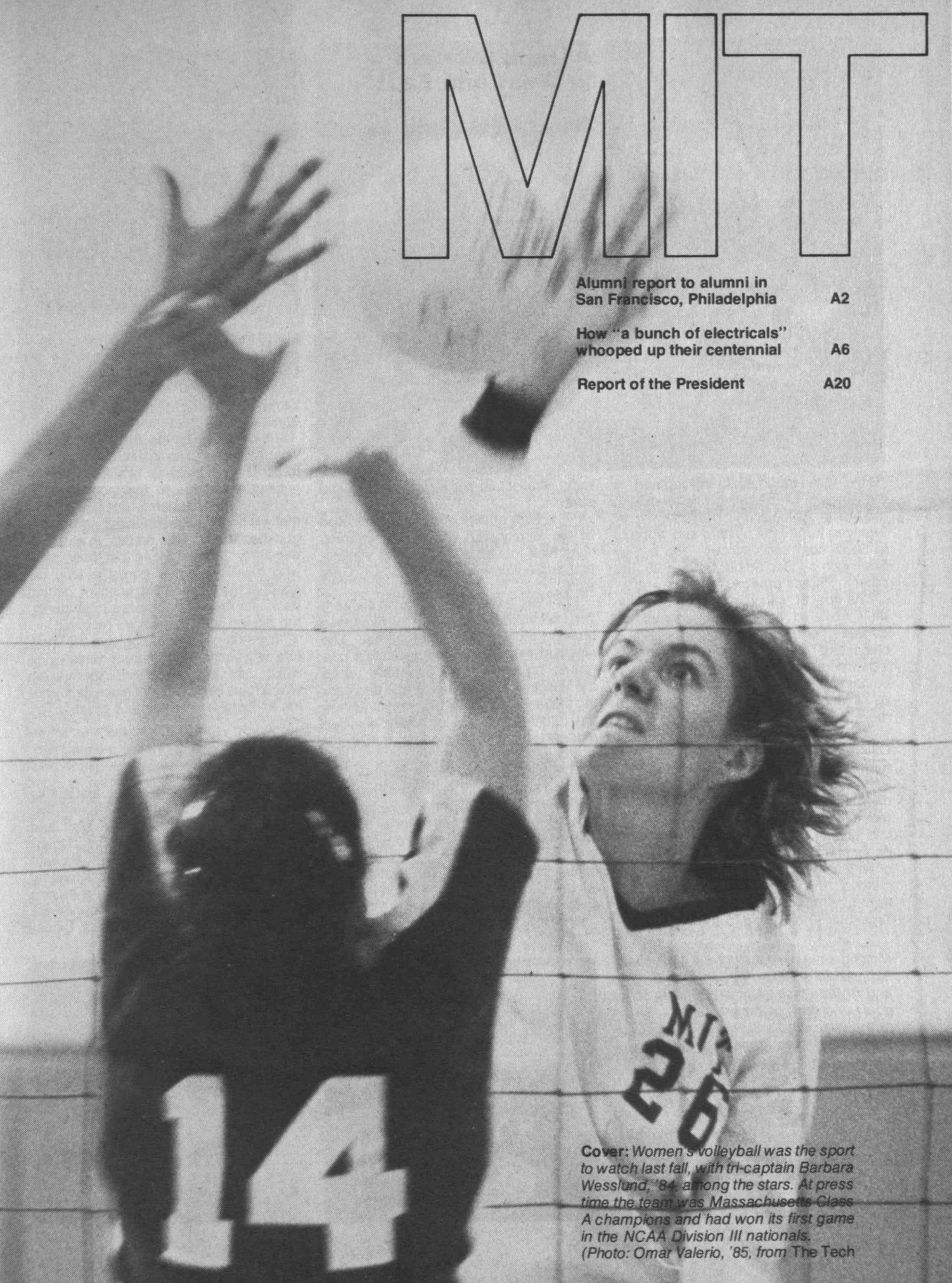
# MIT

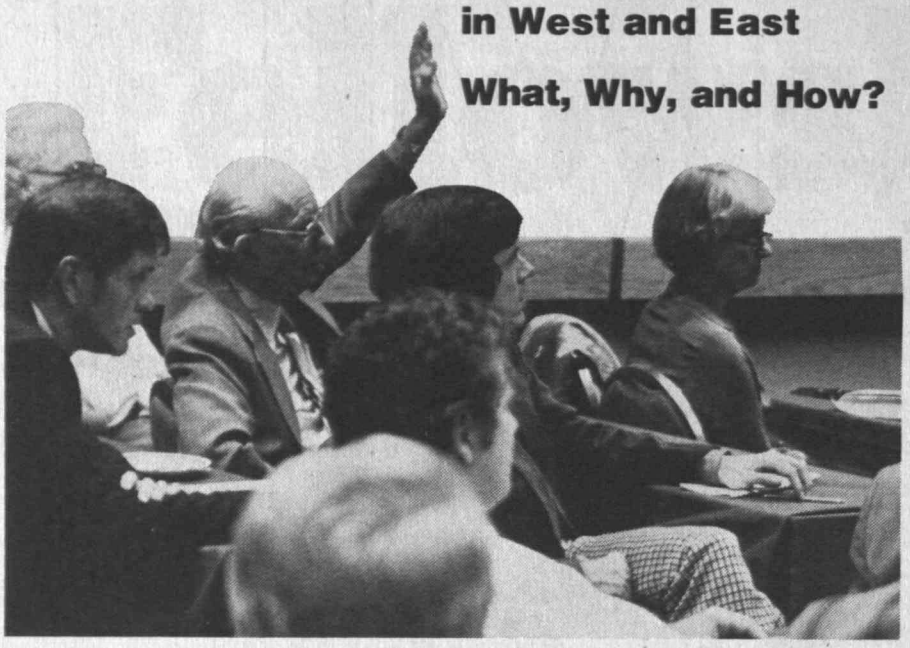




**Cover:** *Women's volleyball was the sport to watch last fall, with tri-captain Barbara Wesslund, '84, among the stars. At press time the team was Massachusetts Class A champions and had won its first game in the NCAA Division III nationals. (Photo: Omar Valerio, '85, from* The Tech

# Alumni Officers in West and East

## What, Why, and How?



"Bringing the mountain to Mohammed" in the words of its executive vice-president, the Alumni Association mounted two conferences for alumni officers and workers in September and October—one in San Francisco on September 24 and 25, the other in Philadelphia on October 8 and 9.

The goal of both was to help alumni in their roles as fund-raisers, educational advisers, and leaders of classes and clubs, and the idea of two regional meetings was to bring this help to alumni who could not travel to Cambridge for the usual annual conference. It worked: of more than 300 attending the two meetings, at least half had never attended a Cambridge-based Alumni Officers' Conference.

President Paul E. Gray, '54, reporting on Cambridge affairs that conference members could not observe first-hand, told alumni at both meetings that "students and faculty are thriving." He spoke of all-time highs in enrollment and applications, "startlingly" high quality of students, student activities which are "vigorous and strong," and "extraordinary" intellectual activities of faculty and staff.

"The high quality of our students, and of the faculty with whom they interact, continues to create an exciting intellectual and cultural environment," Dr. Gray said.

But there are heavy clouds on the horizon, he warned, made up of expenses growing more rapidly than income. The situation threatens all the Institute's programs, he said—and it especially raises the spectre of rising tuition and decreasing student aid funds which may preclude the future admission of highly qualified students with only modest family resources.

The sacrifices which students must make to attend M.I.T.—their obligation to work during the term and to take loans to cover costs—are already higher than at many leading institutions with which the Institute competes for the ablest students, Dr. Gray said. That's chiefly because other institutions' scholarship endowments are larger than M.I.T.'s.

Dr. Gray reminded his alumni audiences that since 1930 tuition has covered only about half of the real cost of an M.I.T. education; the other half came from current gifts and endowment income—that is, primarily from prior generations of students.

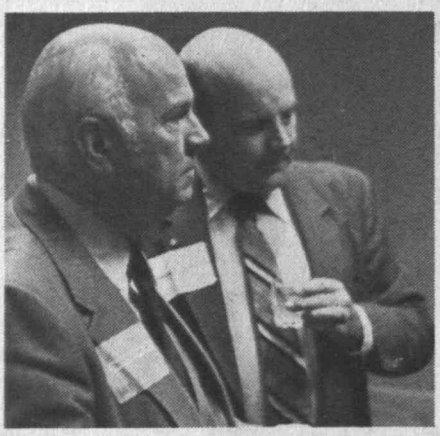
His challenge to his alumni audiences was forthright: "The Institute must, if it is to continue to fulfill its mission of transmitting knowledge to the most capable and promising students, develop a plan that will provide needed support for every qualified student who enrolls. In part," he declared, "that will mean that those of us who have benefitted from the time we spent at the Institute find ways of 'putting back,' for future generations of students, the hidden scholarships we received.

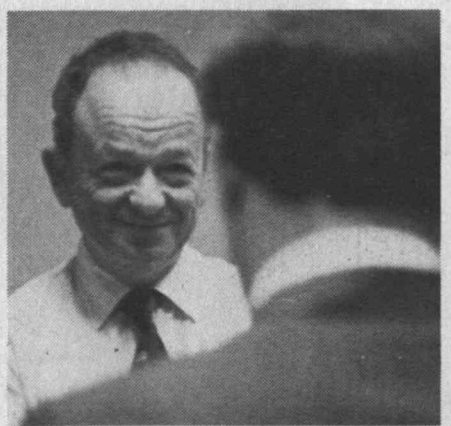
"If we do not do so, I believe the Institute will become a different place—one which has lost touch with the values which have been present since its founding and which have made it great."

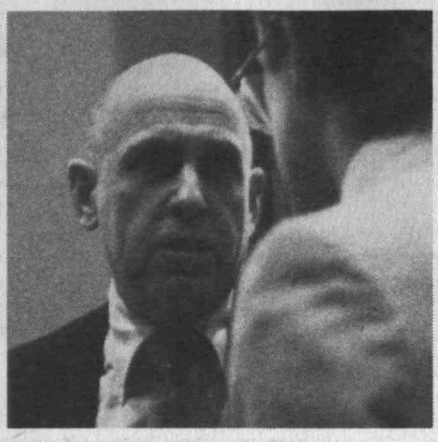
### *"The Thing That Would Help Us Most . . ."*

In the tradition of volunteer leadership which is a hallmark of the Alumni Association, the principal job of staff and volunteers at the two regional conferences was to give alumni the tools with which to help do their work of institutional support. There were sessions on Alumni Fund programs, Educational Council activities, and class and club affairs, focus-

*Plotting a course for 1982-83. More than 300 alumni gathered in San Francisco and Philadelphia early in the fall to set goals and discuss programs for nation-wide fund-raising and networking. (San Francisco photos: Philip L. Molten, '55)*





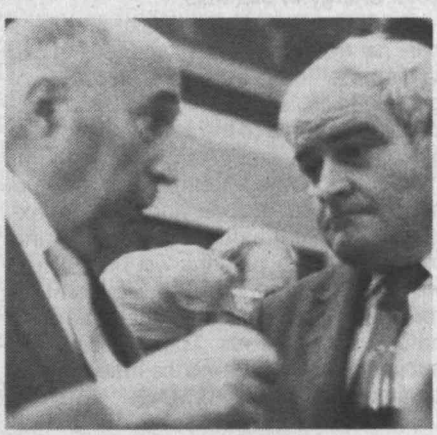


sing on fund-raising, program management and evaluation, and admissions activities. The idea, said William J. Hecht, '61, executive vice-president, was to facilitate "the vital roles of alumni in setting and operating Alumni Association programs and, through them, supporting the Institute and fellow-alumni."

There were lots of useful suggestions. Harbo P. Jensen, Ph.D.'74, president of the M.I.T. Club of Northern California, admitted that the club "pretty much runs on its own, with local talent. The thing that would help us most would be M.I.T. faculty members telling us, in advance, when they are coming to our area, so we could schedule events around them. It's tough to get talent from Cambridge on our programs, but that's what we'd prefer," he said.

For graduate students, ties with course are stronger than ties with class, and placement and career development may be one of the strongest bases for alumni acitivity. To get a piece of that action, said several alumni, clubs need to think

*Continued on page A4*



**VLSI: Retrieving the Top Spot from Industry**

With rare exceptions, the major advances in U.S. semiconductor technology have not come from university laboratories, according to Paul Penfield, Jr., Sc.D.'60, professor of electrical engineering who directs the M.I.T. microsystems program.

Industry's leadership stemmed from the nature of the basic research questions, which until recently were primarily: "How do you make these?" Penfield told 200 alumni and guests at the Alumni Officers' Conference in San Francisco on September 25.

Only Stanford made real contributions at that stage, while M.I.T. was "not as active as it might have been," with what Professor Penfield called a "modest program that was educational, not commercial."

However, he added, while research into the chip-making process continues, new questions have arisen that also need answers: "How do you design them? What functions do you put on them?" In these areas, he predicted, universities in general and M.I.T. in particular will make major contributions.

The M.I.T. microsystems program today involves 20 full-time faculty from four departments and five laboratories. It has $5.1 million in funding, of which $2.7 million comes from the Defense Advanced Research Project Agency. Plans are underway for a new on-campus laboratory complex, due to be ready in 1985; the computer center is to be moved out of Building 39 by 1984, and then $21 million in renovations are to be completed by 1985.

The program focuses on materials for very large scale integrated (VLSI) circuits (in which the number of elements on a single chip exceeds 100,000 submicron structures), semiconductor development, design automation, VLSI system architecture, and VLSI system theory, Professor Penfield said. He believes that industrial firms led early semiconductor research because they concentrated on fabrication, "and they had a vested interest in improving the production line."

Now as research shifts to questions of design and function, universities will take the lead, he believes, because "industry is very timid about new design styles. "Why? You have 50 designs in process. The last thing you want to do is change, because that would delay them."

Incremental, evolutionary improvements in fabrication—better ways of doing things that have been done before—are insufficient to advance the field, Professor Penfield said. In order to solve the "design crisis," he said, "we need revolution, not evolution," and that will come "from universities, not industry."

Work by Professor Dimitri Antoniadis, director of the Microsystems Technical Laboratory, on multilayered silicon technology is an example of university leadership in VLSI research, Professor Penfield said: no significant activity in this area is underway in industrial laboratories. "They do not see this technology as a short-term solution (to their problems)," Professor Antoniadas said, while universities can take a longer view.

Professor Antoniadis described his work as aimed at three areas that should make new kinds of multi-layered circuits possible: crystal melting and regrowth, solid-phase recrystalization, and direct growth. In a different field, Professor Gerald J. Sussman, '68, told the alumni how artificial intelligence has already been applied to the problem of computer-aided chip design. With new programs written in a language called LISP, design of a new microprocessor chip was completed in four man-months—an unusually short design time, Professor Sussman said.—*Paul E. Schindler, '74*

*Continued from page A3*

of themselves as vehicles for networking; departments need a better sense of the importance of alumni relations; and communication about courses and course-mates should be strengthened.

The Alumni Fund reported substantial gains in every category for 1981-82—total giving, number of donors, number and amount of matching gifts, number of gifts over $100, number of first-time givers. But "whenever you have a good year," warned James K. Littwitz, '42, chairman of the Alumni Fund Board, "you

## Energy: Changing Use and Changing Research

Most of the news on energy is good these days—and so hardly news at all. Demand for oil is down—and likely to stay down. Indeed, Professor David C. White, director of the M.I.T. Energy Laboratory, said at the 1982 Alumni Officers' Conference in Philadelphia that he foresees "no resource problem" in energy for "at least 50 years."

Professor Henry Jacoby, who directs the Energy Laboratory's International Energy Studies Program, explained how supply crisis has given away to a "demand crisis," with OPEC nations pinched for cash because demand for their product has plummeted. As world production systems adjusted to the energy cost increases of the 1970s and early 1980s, the amount of energy required per unit of output went down. Now, with a worldwide depression, total output is also down, forcing still lower demand for oil.

Yet world oil consumption has fallen even faster and farther than these two factors can explain, said Professor Jacoby—an unexpected puzzle for economists. The answer seems to lie in "a major worldwide shift" in consumer habits. People take the Toyota instead of the Cadillac, factory managers demand higher efficiencies in all their machines, and we all turn off the lights more conscientiously than ever before.

And to the extent that these new habits of frugality persist, oil demand may never recover, even when the economies of the world turn around and production returns to normal.

There's thus no simple answer to the problem of forecasting future demand and future prices—simply a sense that increases may not come so soon or be so big as once was thought. Indeed, Professor Jacoby told his Philadelphia audience, the price of oil in 1990 may well be no higher than today.

These developments and insights have changed the task of U.S. energy research, said Professor White, from studies of short-range, stop-gap energy strategies to long-range, technical research in energy-consumption and production systems.

For example, instead of pressing for strategies to make today's nuclear reactors safer, nuclear engineers are beginning to think about reactors that are safer because they are much smaller than today's—and fundamentally different in operation, too. There's time now for fundamental research into coal liquefaction and gasification—seeking batter insights into how to increase the hydrogen—and decrease the sulfur content of coal by technologies which we don't now have at all. And perhaps time to breed new plants and develop new systems for capturing solar energy in biomass.

But not all energy-related problems can be treated without urgency, thinks William G. Thilly, associate professor of genetic toxicology. There is growing evidence that some of the complex organics in combustion products, including common components of both diesel and furnace exhaust, are carcinogenic in experimental animals. But transferring these results to humans will be difficult: we're surrounded in our environment by mutagens, and some genetic change is natural, spontaneous. The problems are subtle and complex, and the research will be time-consuming.—*J.M.*

*More than 1,500 alumni have vital roles in admitting every new class of undergraduates at M.I.T. Left, some of them attending the 1982 San Francisco Regional Conference are briefed on admissions policies and problems by Peter H. Richardson, '48, director of admissions, and Bonny S. Kellermann, '72, director of the Educational Council. (Photo: Philip L. Molten, '55)*

make the next year a tougher act." And he also noted, in response to questions, that the total of Alumni Fund giving had not kept pace with inflation in the decade of the 1970s and that M.I.T.'s average gift through the Alumni Fund is lower than that of any Ivy League school.

Denman K. McNear, '48, making his first appearance as president of the Alumni Association for 1982-83, pledged a heavy travel schedule of visits to clubs and conferences with individual alumni. He wants to share his "understanding of the key issues on M.I.T.'s agenda," he told his conference audiences, and to "bring back your thoughts, your counsel, understanding, and support."

*8 Beavers, 6 Citations*

Eight Bronze Beaver Awards, six Presidential Citations, 12 Lobdell Awards and six Morgan Awards—a harvest of honors adequate to fill the programs of two Awards Luncheons at the 1982 Alumni Officers' Conferences in San Francisco and Philadelphia.

The Bronze Beavers—highest awards to alumni for services to M.I.T.—were given by **Denman K. McNear,** '48, president of the Alumni Association, to:

☐ **Leo M. Beckwith,** '35, for "generous support" and "long years of service"—especially in fund-raising activities.

☐ **C. George Dandrow,** '22, for "dedication and loyalty in the highest tradition of the Bronze Beaver."

☐ **Joseph G. Gavin, Jr.,** '41, for "thoughtful leadership . . . for nearly half a century."

☐ **Richard A. Knight,** '47, for "creativity and energetic force (that) have won the respect and affection of alumni throughout the world."

☐ **John L. Riegel,** '19, "one of our most effective and conscientious volunteers."

☐ **Antonio Helier Rodriguez,** '21, for "a lifetime of invaluable service."

☐ **Guy J. Viellet,** S.M.'50, for "building . . . our most active international club" and outstanding support for the Industrial Liasion Program.

☐ **Frank S. Wyle,** '41, for "total commitment in . . . an extraordinary number of positions . . ."

Six activities by alumni organizations won for their sponsors 1982 Presidential Citations:

☐ Career Seminars sponsored by the Association of M.I.T. Alumnae (AMITA), in which successful women "shared their understanding . . . of business and the professions and of the demands and costs of career growth."

☐ The AMITA High School Visiting Program, in which over 100 alumnae set out to "encourage young women of exceptional capacity to continue studying the disciplines of mathematics and science."

☐ The Class of 1942 40th Reunion Gift Committee, "a paradigm for other classes both in terms of committee organization and class projects."

☐ The M.I.T. Club of Milan Technology Symposium, an all-day session to update industry on current thrusts of technology and science . . . "a new and exciting venture."

☐ The M.I.T. Luncheon Club of Washington, D.C., providing "a unique opportunity for alumni to interact with leaders in government and business . . ."

☐ The Technology/Northwest Conference of the M.I.T. Club of Puget Sound, giving Seattle "a first-rate opportunity to understand M.I.T.'s and technology's impact on its community."

Winners of the **Harold E. Lobdell,** '17, Distinguished Service Awards were announced at the Alumni Officers' Conferences, with citations to be delivered at future regional meetings. They are: **Bradford Bates,** '59, for outstanding service to M.I.T. clubs in Boston and Detroit; **S. Martin Billett,** '48, for services to the Alumni Fund and his class; **Roger S. Borovoy,** '56, for service to his class; **Gates W. Burrows,** '25, for distinguished service to the M.I.T. Club of Southern California; **Margaret T. Coleman,** '50, for extraordinary service to AMITA; **N. Bruce Duffett,** '40, for service to his class; **Susan L. Kannenberg,** '61, for outstanding service to AMITA; **Loughrey R. Kuhn,** '67, for service to the M.I.T. Club of Washington, D.C., and the M.I.T. Enterprise Forum of Washington and Baltimore; **G. Edward Nealand,** '32, for service to his class; **Robert P. Pinckney,** '52, for service to the Black Alumni of M.I.T. (BAMIT); **Peter Sexton,** '65, for service to the M.I.T. Club of Fairfield County, Conn.; and **Philip Schwartz,** '23, for devoted service to the M.I.T. Club of Southern California and the M.I.T. Educational Council.

The Morgan Awards, named in honor of **George B. Morgan,** '20, for outstanding service through the M.I.T. Educational Council, were given to six members of the council: **Dempster Christenson,** '38, **Maxwell C. Coutts,** '39, **Stanley Martin,** '50, **Harold Radcliffe,** '41, **John M. Walch,** '48, and **Walter S. Wojtczak,** '37.

# Celebrating the Luminous 100-Year History of "a Bunch of Electricals" in Course VI


*Course VI luminaries. Ten present or former department heads and associate heads pose at the Centennial party: (left to right) Professors Richard B. Adler, '43, Gerald L. Wilson, Sc.D.'65, Mildred S. Dresselhaus, Louis D. Smullen, S.M.'39, Peter Elias, '44, Gordon S. Brown, '31, Joel Moses, Ph.D.'67, Robert M. Fano, '41, Jerome B. Wiesner, and Fernando J. Corbato, Ph.D.'56. (Photo: Calvin Campbell)*

In 100 years since the first six students elected the electrical engineering program of the Physics Department, Course VI has given M.I.T. three presidents and at least as many vice-presidents; it now enrolls one-third of all undergraduates who have chosen majors; and it has been the largest department at M.I.T.—larger in budget than lots of liberal arts colleges—for longer than most people can remember. No wonder that its 100th birthday was celebrated on October 2 and 3 with aplomb nearly rivaling that of the Institute's own centennial some 20 years ago before.

"What a centennial party was the EECS bash!" writes John Melcher, '28, the only representative of his class among some 1,200 faculty, alumni, and guests. He's right. Among the highlights:

☐ Release of a report by the department's Centennial Study Committee calling for a new concept of professional education in the U.S. (see *page 79*) and a new Master of Engineering degree to be awarded to engineers in industry who complete two or more years of part-time study at their workplace followed by at least one term of on-campus study.

☐ A keynote address in which Senator Paul Tsongas (D., Mass.) stressed the importance of high technology to future U.S. prosperity. Making the nation truly competitive in this field, he said, "must be a matter of government policy" pursued by increased investments in basic research, support for training in critical skills, and investments in new, long-range technological advances.

☐ A gift to M.I.T. from Douglas T. Ross, S.M.'54, of 20,000 shares of common stock of SofTech, Inc., of Waltham, Mass., of which Mr. Ross is founding chairman. The gift establishes the Douglas T. and Patricia M. Ross Fund which in turn underwrites the Doug Ross Career Development Chair in Software Technology. "You have put your finger on the most important thing this place does—support faculty," President Paul E. Gray, '54, told Mr. Ross after the surprise announcement.

☐ A birthday picnic/carnival in the Special Events Center at which ten present and former heads and associate heads of the department cut a 1,500-pound birthday cake for a party-going crowd that included most of the department's students and faculty as well as hundreds of alumni and their guests.

### *Making Education Cooperative and Lifelong*

After its year-long study, the Centennial Study Committee concluded that new demands of fast-moving knowledge-intensive high technologies require that education become an "integral component of productive engineering work" continuing virtually throughout an engineer's professional career, and colleges and universities must provide major inputs to these activities.

"Engineers in industry and their university colleagues need a supportive environment in which they can teach and learn from one another," said the study committee's report. "A concerned effort will be required to bridge the many gaps—organizational, social, and temporal—that now separate 'work' and 'study.' "

Professor Robert M. Fano, committee chairman who reported for it at the centennial symposium on October 2, said that his group's recommendations in-

cluded a new master's degree to be given by M.I.T. to engineers in industry and a national committee to sponsor and champion these activities. President Paul E. Gray, '54, responded by reporting that he had already secured acceptance from four leaders in industry and education to join a national council to develop and promote concepts of lifelong cooperative education. Its members will include President Donald Kennedy of Stanford University; Raymond S. Stata, '57, president of Analog Devices, Inc.; Frederick W. Garry, vice-president of General Electric, and Frank T. Cary, chairman of IBM.

Other members of the study committee who joined Professor Fano on the symposium platform were Professor James D. Bruce, Sc.D.'64, director of M.I.T.'s Industrial Liaison Program; Professor William M. Siebert, '46, and Professor Louis D. Smullin, S.M.'39.

Three alumni on the symposium program responded enthusiastically. Mr. Stata characterized the labor pool available to high-technology companies as "a leaky bucket which is losing older engineers (to obsolescence) almost at the same rate as new ones come in. . . . To sustain its growth, high-technology industry needs not just a few but a significant number of knowledgeable and intellectually sophisticated engineers," he said. "The degree of knowledge and sophistication required is the new dimension which is changing the face of the engineering profession."

John A. Young, president of Hewlett-Packard, emphasized the need for industry-university cooperation: Knowledge is very fluid, and so should be the roles of academia and industry. Both sectors, he said, have "a unique opportunity to capitalize on the energy that exists between them—interests, needs, resources, and goals."

Professor Joel Moses, Ph.D.'67, was ready with an example. No one knows how to teach students to design large-scale systems such as VLSI and software. There simply are no powerful principles to teach, and people have to learn by doing. The idea of lifelong cooperative education will help: it will close the gap between the university and the people in industry who have done what we're trying to teach.

And Robert E. Larson, '60, president of Systems Control, Inc., who is also 1982 president of IEEE, pledged that society's support to the new initiative; it's the world's largest professional society, he said, and it already has an impressive record of tutorials and short courses for engineers in industry, including many utilizing the video medium which was proposed by the M.I.T. study committee.

*When Stone and Webster Asked Advice*

Its serious business finished, the 100th birthday party turned to some lighter fare. Who remembers the two students who asked Professor Charles R. Cross, back in the early days when electrical engineering was a course in physics, for advice? They wanted to go into the engineering business together, they said. Professor Cross judged that they'd better change their plans; there might be

*Photos above (clockwise, starting at the top):*

☐ *The panel on lifelong education; (left to right) Professors William M. Siebert, '46, James D. Bruce, Sc.D.'64, Mildred S. Dresselhaus, Louis D. Smullin, S.M. '39, and Robert M. Fano, '41.*

☐ *Professor Harold E. Edgerton, Sc.D.'31, (left) with Cecil H. Green, '23.*

☐ *Led by Gordon S. Brown, '31, the department heads cut the cake.*

☐ *A standing ovation for Douglas T. Ross (left), S.M.'54, led by President Paul E. Gray, '54.*

☐ *Raymond S. Stata, '57, a charter member of a new council to promote lifelong education.*

*Celebrating 100 years of Course VI: Right: Kenneth J. Germeshausen, '31, with Warren A. Seamans in the Compton Gallery. Below: Edward L. Bowles, '22 (left), with Albert J. Pyle, '23, and Julius A. Stratton, '23. Bottom: Senator Paul Tsongas (right), keynote speaker, greeted by Professors Smullin and Fano.*

enough work for one but surely not enough for two. The students disregarded his advice. Their names: Charles A. Stone and Edwin S. Webster.

John Melcher, '28, remembers when he took an examination as a surrogate for Yancey Bradshaw, '28. Both had transferred to M.I.T. from Kansas City Junior College, and both sought to transfer their junior college credits in calculus and chemistry. The exams in the two subjects were given at the same time, and it was finally determined that Melcher would take one, Bradshaw the other. Since each was assumed to be as well prepared as the other, passing grade by Melcher in chemistry would also qualify Bradshaw, and vice versa for mathematics.

Professor Richard B. Adler, '43, reviewed the qualifications of some of the department's half-century club: Gordon S. Brown, '31, the "Maxwell demon" of a new curriculum, whose effect on M.I.T. was "not compartmentalizable." . . . Paul E. Gray, '54, the department's "Mr. Applied Electronics." . . . Harold E. Edgerton, Sc.D.'31, who drew the banquet toastmaster's assignment because of his reputation for keeping seminar speakers within their allotted times.

*An Image-Maker for 100 Years*

Why so many good years for Course VI?

Here's President Gray's list of its special strengths—his "summary of what matters"—from his banquet address:

☐ Steadfast attention to the importance of teaching.

☐ Willingness—indeed, insistence—on coupling with real problems on a large scale and in a big way.

☐ Overriding concern for quality.

☐ Connectedness with "the rest of us" at M.I.T.

It is, he said, a "luminous history" with an "unparalleled influence" on the profession, on other institutions, and on M.I.T.—*J.M.*

**Sports Report**
**Ken Cerino**

# "Old Number Three": A Complete Education

*Ken Cerino is starting his fourth year as director of sports information; he is currently president of the Eastern College Athletic Conference Sports Information Directors' Association (ECAD-SIDA).*

He came to M.I.T. in September, 1979, ready for the academic and athletic challenges of college life.

Now Mark Branch is getting ready to receive his degree in chemical engineering.

A 5'10" senior guard from Raleigh, N.C., Branch is the co-captain of the 1982-83 M.I.T. basketball team.

Twenty-two more basketball games, a couple of problem sets, and it's over. Then it's goodbye to the cozy, memory-filled room in McGregor Hall.

*Knocking in 15-Footers*

When Mark Branch appeared at basketball practice on October 15, 1979, Coach Fran O'Brien nearly had a heart attack. O'Brien had received a postcard from Branch the previous spring saying he was interested in trying out for the squad. Most times, though, such players just don't show.

Branch was different. He attended Needham B. Broughton High in Raleigh where he was a conference all-star. Basketball is serious business in Carolina and Needham B. Broughton has a proud tradition in basketball with former pro star Pete Maravich among its more prominent alumni.

After watching Branch glide up and down the court knocking in 15-footers like a seasoned veteran and making crisp, accurate passes, O'Brien knew he had a player.

Branch came to M.I.T. at the right time. Tech basketball was 5-17 the previous year and had suffered through seven straight losing seasons. There were always outstanding players at M.I.T. but never enough of them at the right time.

Teaming with all-star forward and Academic All-American Ray Nagem, '80, and blending in with solid players like Bob Clarke, Geoff Holman, '80, and Robert Joseph, '82, Branch and company won 13 of 22 games in 1980. O'Brien was named National Collegiate Athletic Association (NCAA) Division 3 Northeast coach-of-the-year, and respectibility returned to the friendly confines of Rockwell Cage.

Branch and his teammates started the 1980-81 season off with an exciting 65-63 upset road victory against Brandeis. It was M.I.T.'s first win over the Judges in 12 years. Later in the season came a thrilling 74-72 overtime win against Bates College as Branch scored 13 of M.I.T.'s final 14 points. Last year, the Engineers lacked a big, dominant center and despite Branch's best offensive output (16.7 points a game), M.I.T. fell to 7-17.

In 69 games, Branch has scored in double figures 58 times (his career high is 31). He has been to the foul line 510 times. Quick and an above-average defensive player, Branch had a school record of ten steals in a game last year against Yeshiva.

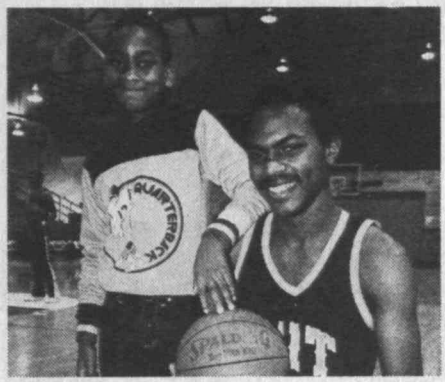
"Mark is one of the premier point guards in New England," says O'Brien. "He has been the leader for us the last four years and he's been a pleasure to be around. We're going to miss him.

Last year, Branch joined the M.I.T. chapter of the NCAA Volunteers for Youth program. M.I.T. is among 50 institutions in the nation which sponsors the program in which athletes are matched one-to-one with local youngsters according to mutual interests.

Branch's "little brother" is 11-year-old Curtis Ewing, a seventh-grade student at the Fletcher School in Cambridge. Both Branch and Ewing are only children and both are serious enthusiasts.

"Curtis is bright, witty, and versatile," says Branch. "He does well in school and, like me, he is a guard on his school's basketball team. We do a lot of things together like play video games and walk around Cambridge. Curtis even comes to M.I.T. basketball games. In fact, we've worked out together and he gives *me* tips on how to play.

"When I was growing up in Raleigh, I played with older and bigger boys. They supported me playing ball with them and they also impressed upon me the importance of getting an education and working hard.



*Eleven-year-old Curtis Ewing of Cambridge was matched with co-captain Mark Branch, '83, by the NCAA Volunteers for Youth Program. Now they work out together and "he gives* me *tips on how to play," says Branch. Coach Frank O'Brien recalls how he knew this was a real player the minute he saw Branch on the court as a freshman.*

"I joined the VFY program because I felt it was an excellent opportunity for me to pass along what I learned from them. I'm glad I met Curtis because he has been an important addition to my M.I.T. education. He's a special friend."

*Winning Attitude Every Time*

The final pieces of the college puzzle are starting to fall into place for Branch.

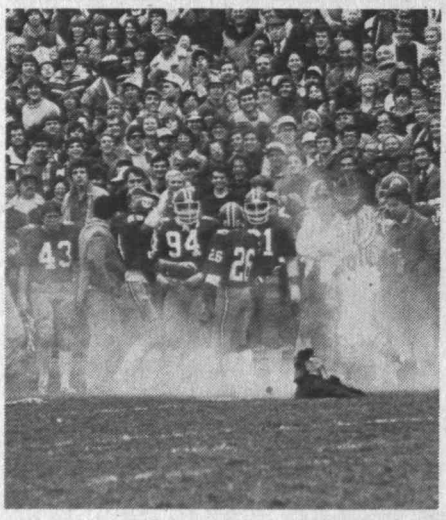
"Right now, I'm preparing for my final basketball season," he explained. "At the very least, we feel we can be a .500 team. Practices have been spirited and competitive. We want to develop that winning attitude every time we walk on the court.

"I feel real good about my decision to attend M.I.T. because of all the friendships I've developed. I can remember all the guys I've played basketball with, and all the people associated with the program from John Murphy (equipment supervisor) on down.

"I came here for a complete education, and I have received that and more. I'm grateful for being exposed to the expertise of my professors and to the intellect of my peers. I'm especially grateful to Coach O'Brien for always taking the time to listen to me. He's been a mainstay in my education. He's a great coach and friend.

"Old number three," as M.I.T. athletic director Royce Flippin calls him, has compiled an enviable record at M.I.T. Rockwell Cage certainly won't be the same without him. It's too bad that time sometimes flies by a little too fast.

# It Was Harvard Over Yale, But M.I.T. Won the Game

At first it was a little black bubble the size of a golf ball . . . then a tennis ball . . . then a softball . . . then a basketball . . . then a beach ball . . . and then a weather balloon.

. . . erupting out of the hallowed ground of Harvard Stadium just after Harvard's second touchdown against Yale in the second quarter of this classic confrontation on November 20.

There was plenty of time for 40,000 spectators and countless reporters to read its simple message: "M.I.T." Then a tiny pop, a little pile of black plastic, and silence.

Within an hour this mystifying spectacle was receiving rave notices as one of the most public, captivating, and original events in the history of college "hacks." In a front-page story, Michael Madden of the *Boston Globe* called it "the Prank of all pranks. . . . If you want to know the truth, M.I.T. won The Game."

President Derek Bok of Harvard, quoted by Mr. Madden, reacted first with concern ("I sat there and didn't really know what to think") and then with admiration: "They have an awful lot of clever people down there at M.I.T., and they did it again. I still don't understand how they did that, making a balloon rise as they did."

President Paul E. Gray, '54, told *The Tech*, "There is absolutely no truth to the rumor that I had anything to do with the planning and promoting of (the stunt), but I wish there were." (*The Tech*'s headline for the story: "Saturday's Score: MIT 1, Harvard-Yale 0".)

*"The hardest part was scalping tickets for the game" so everyone in the Delta Kappa Epsilon house could see their handiwork in action, said Deke president Bruce Sohn, '83, at a press conference on November 22. The six-foot balloon rising out of the ground of Harvard Stadium quickly took its place as "one of the greatest college pranks in history," said Bob Lobell of Boston's Channel 4. (Photos: Nevin I. Shalit from the Harvard Crimson, Robert J. Brooks, '85)*

After 48 hours of savoring the world's admiring curiosity, Delta Kappa Epsilon fraternity broke its silence at a full-fledged press conference in the living room at 403 Memorial Drive. We did it, said Deke president Bruch Sohn, '83, smiling ear-to-ear and surrounded by chortling brothers.

The balloon was pushed out of the ground by a hydraulic ram driven by freon gas, then filled with air pumped by a vacuum-cleaner motor. Marbles found on the grass by the clean-up crew were the bearings on which the cover slid.

The device had been planned for months—maybe years, built within the previous four weeks, and placed in Harvard Stadium during eight separate nighttime expeditions (between 1 and 5 a.m.), culminating on November 16. "We pretty much had free access to the stadium," said Mr. Sohn. Guards were stationed in the bleachers to watch for the Harvard Police, and "we never came near to getting caught."

Power for the device came from a special 110-volt circuit under the stadium that they concluded is used only for irrigation. The Dekes concealed their wiring under a door, along the base of the stadium, and out to the 40-yard line. At one point the wire was slipped under a concrete form, and the next night they discovered cement poured on top. To start the action on November 20, two members of the Deke house had only to flip a circuit breaker and push a plug into an outlet.

Was it safe?

Very, insisted Mr. Sohn. The electric circuit off which the device operated was not in use during the game for any stadium services. The balloon contained only air. And a note of explanation was attached to reassure anyone who took on the heroic task of defusing a dangerous explosive that wasn't there.

"It went exactly as we planned," exulted Mr. Sohn.

"One of the greatest college pranks in history," concluded Bob Lobell on Boston's Channel 4.

### Funds Drawn Down in 1981-82 as Expenses Exceed Income

Just over $1 million of M.I.T.'s funds functioning as endowment—and nearly $1 million from other funds and reserves—were required to balance the Institute's books at the end of the 1982 fiscal year—the first time since 1977 that operating expenses exceeded all available current income resources, according to Stuart H. Cowen, vice-president for financial operations, and Glenn P. Strehle, '58, treasurer, in their annual report to the M.I.T. Corporation.

Whether operations can be returned to balance in future years, said Messrs. Cowen and Strehle, "will depend upon the Institute's success in its programs to control expenses and to develop growing financial resources."

M.I.T.'s total operations were $515.4 million in 1981-82, up 8.2 percent from 1980-81. Revenues were up 7.8 percent.

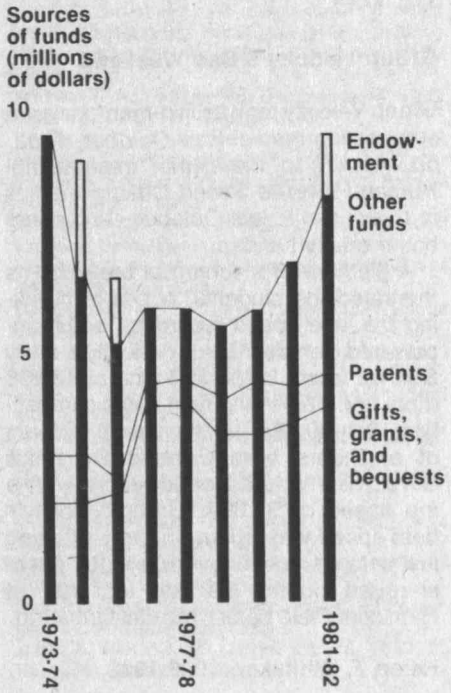
Gifts, grants, and bequests in 1981-82 were just over $41 million, down less than 5 percent from the record total of $42.9 million in 1980-81. Though some of the giving in 1981-82 represented pledges from the M.I.T. Leadership Campaign of the late 1970s, most resulted from new commitments. "The objective of the campaign—to develop a new and higher level of annual gift support—has been achieved," write Messrs. Cowen and Strehle.

Undergraduate scholarship grants were over $11 million in 1981-82, almost 24 percent over the previous year. These grants required $3.1 million from unrestricted revenues in 1981-82, compared with only $1.9 million required in 1980-81. This major demand on unrestricted funds was necessary primarily because new scholarship resources have not kept pace with the inflation-driven cost of an M.I.T. education; changes in the funding of federal programs also contributed.

*Modest Commitment to Alternative Investments*

Investment income was slightly higher in 1981-82 than in the previous year—$35.4 million compared with $33.4 million—primarily because of increased holdings of fixed-income securities and higher income from investment real estate. Meanwhile, write Messrs. Cowen and Strehle, under the guidance of the Corporation's Investment Committee there was in 1981-82 "an increased emphasis toward identifying long-term investments that produced both high current returns and equity participation. These included both real estate investment funds and convertible debt securities. The overall commitment to alternative investments is also diversified among venture capital—limited partnerships, foreign common stocks, and selected private placements.

"In the aggregate, however, these investments are still a modest proportion of the portfolio. We have continued to maintain a major commitment to equities and have avoided frequent shifts in the allocation of assets," write Messrs. Cowen and Strehle.




*The uses of unrestricted revenues and funds. Throughout the past nine years, all research facilities allowances and patent revenues, as well as substantial portions of unrestricted gifts and bequests and other available funds, have been used to bring current operations into balance. And in three years—1975, 1976, and 1982—capital from funds functioning as endowment has been required to balance the budget.*

### Florida Festival March 12-13

Alumni tired of winter—as well as those who have gone forth to escape it—will be welcome at the 1983 Florida Festival in Orlando on March 12 and 13.

Professors Robert W. Mann, '50, and Jeremy M. Wolfe will speak in an afternoon session on Saturday, the former on engineering approaches to prosthetic devices and human rehabilitation, the latter on human visual perception. At dinner that evening the speaker will be Gerald L. Wilson, '61, dean of the School of Engineering.

Headquarters for the festival will be the Sheraton-World Hotel, and tours of the new EPCOT Center nearby will be available on Sunday. For further information: Joseph J. Martori, Room 10-110, M.I.T.

### A Vote for DEC and Philips

Future M.I.T. purchases of word-processing equipment will be from two major makers: Digital Equipment Corp. and Philips Information Systems.

Surveying the market and the advantages of standardization, an Office Automation Planning Committee has recommended these choices on the basis of six criteria: the quality and capability of current products; likely future capability; flexibility in architecture; cost; compatibility with the existing M.I.T. environment; and user interfaces. Proliferation of equipment designs and rapidly decreasing prices have posed a dilemma for word-processor buyers, making the decision of what machine to buy ever more time-consuming and therefore costly, says the committee. Hence the recommendation.

Philips equipment is recommended for offices with extensive technical typing requirements and DEC equipment for other offices.



### Mexican Fiesta to Oaxaca

Oaxaca, a renowned archeological site 250 miles southeast of Mexico City, will be the principal location of the 35th annual M.I.T. Fiesta in Mexico on March 4 through 9. With the Mexican peso depressed this year, the cost of the Fiesta will be substantially reduced for 1983—to about $350 for all land arrangements, according to Joseph J. Martori, associate secretary of the Alumni Association.

The group will gather in Mexico City on March 4, flying to Oaxaca (45 minutes, about $50) on Sunday, March 6. March 7 and 8 will be devoted to tours of colonial Oaxaca and the pre-hispanic sites at Mitla and Monte Alban, concluding with a farewell "guelaguetza" native folk festival. Arrangments are being completed by Rogelio Moreyra Sandoval, '78, and Hector Orozco, '45, president and treasurer, respectively, of the M.I.T. Club of Mexico, and further information is available from Mr. Martori at Room 10-110, M.I.T.

### Group Velocity's Bad Weekend

Group Velocity took its five-man-powered engineering marvel (*see October, 1982, pp. A6-A7*) to the eighth International Human-Powered Speed Championships in Irvine, Calif., last October—and came home empty-handed.

A plethora of mechanical breakdowns frustrated the students' hopes of breaking the land speed record for a human-powered vehicle. Group Velocity's entry finished fourth in the first race at 42.258 mph, and third in the next day's competition, with 49.424. Vector Group, a team of engineers from General Dynamics Corp., defended its world record with a top speed of 57.899. Group Velocity's best speed was about 53 mph, attained just before one of the vehicle's outriggers snapped during the last test run at Hanscom Field before the California trip.

### Helen F. Whitaker, 1906-1982

Mrs. Helen F. Whitaker, who with her late husband, Uncas A. Whitaker, '23, was a major benefactor of education and research in the life sciences at M.I.T., died on September 14 in Naples, Fla. She was 76.

Mrs. Whitaker became a member of the M.I.T. Corporation in 1976, shortly after her husband's death; she later became a life member and then emerita. Her association with the Institute began through her husband's interests; together they were early advocates of the life sciences and of the cooperative arrangements between M.I.T. and the Harvard Medical School in health sciences and technology. Their contributions made possible construction in 1965 of the Whitaker Building which now houses elements of the Biology and Nutrition and Food Science Departments; later, following her husband's death, Mrs. Whitaker played a leading role in fianancing and planning the new buildings which now house the Whitaker College. Her life "exemplified the creative spirit of private philanthropy," said President Paul E. Gray, '54.

Mrs. Whitaker was born Helen Fisher in Toledo, Ohio; the family later moved to Canton, Ohio, and following their marriage Mr. and Mrs. Whitaker lived in Harrisburg, Pa. In all these places Mrs. Whitaker made major contributions to public and social service.

### Donald S. Appleyard, 1928-1982

Donald S. Appleyard, M.C.P.'58, who served on the M.I.T. faculty for six years before joining the University of California in Berkeley in 1967, was killed on September 23 by a speeding automobile in Athens, Greece; he was 54.

Professor Appleyard was widely known for his work in city and neighborhood planning, where he was considered an advocate of making neighborhoods hospitable to people—not to automobiles. He was the author of several books in the field and was at the time of his death co-editor with Professor William L. Porter, Ph.D.'69, of a new environmental design journal to be called *Places*.

Professor Appleyard was born in England and came to M.I.T. after receiving an undergraduate degree from the Architectural Association School of Architecture in London. In addition to teaching, research, and writing, Professor Appleyard was widely known for consulting work in city and neighborhood planning in the U.S., Latin America, and Africa. He was a major contributor to San Francisco's master urban plan.

#### Deceased

*Minot S. Dennett,* '11; September 17, 1982; 2850 N. Sheridan Rd., Apt. 207, Chicago, Ill.
*James A. Cook,* '12; September 20, 1982; c/o R.T. Harris, 96 Village St., Marblehead, Mass.
*Raymond B. Haynes,* '13; September 15, 1982; 1088 Park Ave., New York, N.Y.
*Arthur W. Vose,* '13; February 20, 1982; 30 Curtis Rd., PO Box 109, Milton Village, Mass.
*Alfred D. Chandler,* '14; September 13, 1982; 2500 Montchanin Rd., Wilmington, Del.
*Freeland H. Leslie,* '14; July 6, 1982; 310 S. Ocean Blvd. #103, Boca Raton, Fla.
*Fiske R. Jones,* '15; February 4, 1982; 164 White St., Lunenburg, Mass.
*Mrs. Edward J. Kingsbury,* '15, April 18, 1982; c/o P. Frechette, 70 Bradford Rd., Keene, N.H.
*Virgil E. Wardwell,* '15; September 11, 1982; 38 Red Fox Rd., Stamford, Conn.
*Elmer C. Matthews,* '17; July 24, 1982; 1422 Roosevelt, Orlando, Fla.
*Ralph Stanley Leonard,* '18; May 23, 1982; RFD 1 Box 182, Laconia, N.H.
*Nelson A. Bond,* '19; July 26, 1982; 2114 Rankin Rd., Schenectady, N.Y.
*Henry H. Blau,* '20; February 11, 1980; 48 High-

land Circle, Wayland, Mass.
*George I. Brown,* '20; January 23, 1982; 1421 Henderson Dr., Kalamazoo, Mich.
*Austin R. Frey,* '20; June 1982; 4046 Costado Rd., Pebble Beach, Calif.
*Willard A. Brolin, Jr.,* '21; February 18, 1982; 315 North Rockford Ave., Rockford, Ill.
*Luther Goff,* '21; September 7, 1982; 19 Bowden Ave., Barrington, R.I.
*Sydney W. Gould,* '21; January 28, 1982; 5 Opening Hill Rd., Madison, Conn.
*John A. Scarlett,* '21; October 1977, 321 Semple St., Modesto, Calif.
*Anders V. Johnson,* '22; December 21, 1981; 85 Williams St., Malden, Mass.
*Russell F. Greenough,* '22; May 20, 1982; 41 Dow Ave., Arlington, Mass.
*Ralph E. Rubins,* '23; July 26, 1982; c/o Mr. F.K. Rubins, 729 Verna Ave., Newbury Park, Calif.
*Hudson Hoagland,* '24; March 5, 1982; 135 Deerfoot Rd., Southborough, Mass.
*Theodore C. Lonnquest,* '25; March 9, 1982; 4110 Aspen St., Chevy Chase, Md.
*Harry G. Olson,* '25; October 1981; 100 Bluff View Dr., Apt. 407C, Bellaire Bluffs, Fla.
*Francis J. Turnbull,* '25; October 1981; 625 Pleasant St., Milton, Mass.
*John E. Yarmack,* '25; October 6, 1982; 126 Elm St., San Mateo, Calif.
*Robert H. Brunton,* '26; July 22, 1982; 36 Lanark Dr., Westwood, Mass.
*Russell L. Damon,* '26; September 11, 1982; 1135 Lawrence Ave., Point Pleasant, N.J.
*George P. Milmine,* '26; September 24, 1982; Wildwood, RT 1 Box 11, Lakeville, Conn.
*John G. Pew,* '26; July 31, 1982; PO Box 2880, Dallas, Tex.
*Francis R. VanBuren,* '26; January 21, 1982; Bayview Rd., Harwich Port, Mass.
*Lloyd A. Bingham,* '27; January 30, 1982; 35 University Circle, DeLand, Fla.
*Arthur B. Guise,* '27; August 24, 1982; 1015 Edwin St., Marinette, Wisc.
*Norman C. Parsons,* '28; January 22, 1982; 25 Camellia Dr., Ormond Beach, Fla.
*Thaddeus L. Sharkey,* '28; 3503 Raymond St., Chevy Chase, Md.
*Henry E. Simonds,* '28; January 29, 1982; 209 Highland Ave., Winchester, Mass.
*Kenneth C. Blanchard,* '29; May 4, 1982; One East Chase St. #812, Baltimore, Md.
*Joseph A. Bonner,* '29; November 11, 1975; 904 Harvard Ave. #58, New Haven, Conn.
*John B. Ellsworth,* '29;. January 30, 1982; Ragged Mt. Fish & Game Club, BX 2B, Potter Place, N.H.
*Charles Lukens Huston, Jr.,* '29; October 1, 1982; 1508 Mt Pleasant Rd., Villanova, Penn.
*Arthur K. Scott,* '29; August 19, 1982; 524 Dudley Ct., Westfield, N.J.
*Hubert B. Whiting,* '29; January 20, 1982; 16736 Diego Dr., Rancho Bernardo, San Diego, Calif.
*John M. Cleary,* '30; October 27, 1981; 1000 Weidman Rd., Manchester, Mo.
*Herbert W. Ehrgott,* '30; September 20, 1982.
*Dominick J. Mastrangelo,* '30; February 25, 1982; 60 Southlawn Ave., c/o Anges Griesar, Dobbs Ferry, N.Y.
*Morton B. Curley,* '31; July 20, 1982; 426 S Austin Blvd., Oak Park, Ill.
*Francis X. Forest,* '31; June 4, 1982; 16 Church St., Belfast, Me.
*Davis D. Lewis,* '31; July 28, 1982; 400 E Vine St., Millville, N.J.
*John L. Reid,* '31; September 1982; 1000 Rio Vista Ave., Red Bluff, Calif.
*Harold E. Searles,* '31; December 8, 1981; 59 Liberty Ave., Lexington, Mass.
*Joseph T. Cimorelli,* '32; June 21, 1982; 10 Cromwell Dr., Morristown, N.J.
*Thomas P. Dunleavey,* '32; August 4, 1982; 9 Rusling Pl., Bridgeport, Conn.
*Donald W. Fetters,* '32; May 21, 1982; 222 Crystal Springs Dr., Hendersonville, N.C.
*George D. Freeman,* '32; December 5, 1981; 942 Tomorro Ln., Fallbrook, Calif.
*Frederick L. Mahoney,* '32; January 1, 1982; 529 Edgar Rd., Westfield, N.J.
*Leo Goodman,* '33; September 27, 1982; 2948 Macomb St. NW, Washington, D.C.
*Edward W. Kimbark,* '33; February 8, 1982; 3233 NE Thompson St., Portland, Ore.
*Warren Campbell Nelson,* '34; June 30, 1982; 214 E. 6th St., Ontario, Calif.
*Frederick H. Pattee,* '34; July 3, 1982; PO Box 287, Monmouth, Ill.
*Damon E. Francisco,* '35; February 7, 1982; 2 Upland Rd., Taunton, Mass.
*Alexander Kazutoff,* '35; September 1976; 29500 Heather Cliff Rd., Apt 157, Malibu, Calif.
*Anthony M. Lowell,* '35; July 24, 1982; 3645 Peachtree Rd. NW #105, Atlanta, Ga.
*Vincent C. Sorrentino,* '35; October 3, 1982; 137 Cambridge Turnpike, Concord, Mass.
*Norman G. Bull,* '36; December 20, 1981; 508 E Franklin Ave., Neenah, Wisc.
*George L. Thompson,* '37; April 17, 1981; 14851 Devonshire Ave., c/o Thompson, Tustin, Calif.
*F. Charles Moesel,* '40; May 26, 1982; 1937 Whitehall St., Allentown, Penn.
*Donald K. Duffey,* '41; July 22, 1982; 2602 Duncan Rd., Wilmington, Del.
*Fredrich H. Olsen,* '42; July 26, 1982; Leetes Island, Guilford, Conn.
*Albert J. Kelly, Jr.,* '43; September 22, 1981; 5145 S. E. Miles Grant Terr., Stuart, Fla.
*Sherwood H. Dodge,* '44; April 5, 1982; 6232 Glide Ave., Woodland Hills, Calif.
*Robert L. Hunter,* '44; September 18, 1982; PO Box 1289, Rancho Santa Fe, Calif.
*Ben G. Bromberg,* '47; September 10, 1982; 16971 Westport Dr., Huntington Beach, Calif.
*Walter Kisluk,* '47; April 1982; 431 N Adams St., Hinsdale, Ill.
*Andrew T. Raczynski,* '48; September 14, 1982; 150B Pony Run Rd., Raleigh, N.C.
*James A. Griswold,* '49; April 8, 1973; 636 E Mariposa Dr., Redlands, Calif.
*William E. Krag,* '50; August 26, 1982; 22 Slocum Rd., Lexington, Mass.
*Charles S. Tallman,* '50; July 18, 1982; 831 Cliff Dr. #A3, Santa Barbara, Calif.
*Raymond L. Madsen,* '51; February 17, 1982; 914 Sandra Ct., Brea, Calif.
*Douglas Michel,* '51; June 7, 1982; 6341 Cocoa Ln., Apollo Beach, Fla.
*John D. Ryan,* '51; February 19, 1982; 12402 Fairpoint Dr., Houston, Tex.
*Sylvan L. Sacolick,* '54; February 8, 1980; 160 E 84th St., New York, N.Y.
*Harold T. Hendrickson,* '56; August 28, 1982; 801 28th Ave. W Seattle, Wash.
*Donald S. Appleyard,* '58; September 23, 1982; 217 Hillcrest Rd., Berkeley, Calif.
*W. Russell Hamon,* '60; August 5, 1982; 3494 Bathhurst Ct. Lexington, Ky.
*Peter H. Levine,* '63; November 29, 1977; 6464 Sunset Blvd., Los Angeles, Calif.
*Lynn J. Taylor,* '63; August 7, 1982; 6778 Bowerman St. E. Worthington, Ohio.
*Julian S. Hartwell,* '67; September 25, 1982; 54 Rust Way, Cohasset, Mass.

# Courses

## I

### Civil Engineering

**Paul F. Rice,** S.M.'47, reports that he is vice-president—engineering, at the Concrete Reinforcing Steel Institute and is co-author of *Structural Design Guide to the ACI Building Code* and *Structural Design Guide to the AISC Specifications for Buildings*. He also was the recipient of the 1981 Alfred E. Lindau Award for service to ACI technical committees and technical publications.

**Stephen H. Haybrook,** S.M.'45, of Poland, N.Y., passed away on June 24, 1982; no details are available.

## II

### Mechanical Engineering

**Philippe Villers,** S.M.'60, founding president of Automatix, Inc., a company that builds industrial robots, is funding a $40 million foundation to deal exclusively with problems of aging and the elderly. According to a year-old prospectus, the foundation's purpose is to reshape public attitudes and policies concerning the elderly, and it is to "have a major impact in bringing about change over at least two decades." Mr. Villers declined comment when queried by the *Washington Post* late last summer.

**Adrian Bejan,** Ph.D.'75, is the author of a new textbook on *Fluid Flow* (New York: John Wiley and Sons, 1982, $39.95) described by its publisher as the first "to bridge the gap between three cornerstones of engineering education—fluid mechanics, thermodynamics, and heat transfer." Dr. Bejan is associate professor of mechanical engineering at the University of Colorado.

**Edward A. Sziklas,** S.M.'53, has been named assistant director of research at United Technologies Research Center, New Haven, Conn. . . . **Eric G. Newberg, Jr.,** S.M.'46, commander of the Narragansett Bay Chapter of the Military Order of the World Wars, has been appointed as the Rhode Island state commander. He is also a member of the National Chapter Development Committee and the Legislative Committee. . . . **Paul J. Remington,** Ph.D.'65, is currently a principal in the firm of Bolt Beranek and Newman, Inc., Cambridge, Mass.

## III

### Materials Science and Engineering

The first presentation of the annual H. H. Uhlig Student Grant by the Greater Boston Section of the National Association of Corrosion Engineers was made early last fall to Gerald S. Frankel, a graduate student in the department. The award honors the contributions of Professor Emeritus **Herbert H. Uhlig,** Ph.D.'32, who was present for the award at the NACE's first meeting of the current year.

**H. Kent Bowen,** Ford Professor of Engineering who pioneered and developed the Ceramics Processing Research Laboratory in the Center for Materials Processing, is now the center's director; he succeeds Professor **Merton C. Flemings,** '51, who resigned from the leadership of the center upon becoming head of the department last summer. Professor Bowen's interest in ceramic materials for advanced energy systems led to a joint appointment in electrical engineering in 1975, when he also became a program director in the M.I.T. Energy Laboratory; he has been associate director of the Center for Materials Processing since its founding in 1979.

The Mary B. Norton Memorial Scholarship of ASTM has come to **Michelle W. Gabriel,** '82, a master's-degree candidate in the department at M.I.T. Ms. Gabriel is a cooperative student at IBM in Hopewell Junction, N.Y., studying the wettability of lead-selenium solders; the ASTM award is made annually to a woman pursuing undergraduate or graduate study in metallurgy or materials science.

## IV

### Architecture

**Reinhard Goethert,** M.Arch.'70, research associate in the department at M.I.T., has submitted the following news: "At the end of September, alumni from throughout the world attended a gathering marking the beginning (15 years ago) of M.I.T.'s Urban Settlement Design Program. The program, started with a grant from the Ford Foundation to investigate self-help housing techniques, is now concerned primarily with more efficient land-subdivisions strategies in urban areas of developing countries. Of the 116 students from 26 countries who had completed the program since 1965, approximately 50 attended. During the reunion, each day was oriented around a different perspective of housing—from educators, practitioners, and agencies.

"At the concluding meeting, the former students established an Association of Settlement Design Alumni to encourage and reinforce architecture education directed toward housing in developing countries. As an indication of their seriousness, a scholarship fund was established and presented to Professor John de Monchaux, dean of the School of Architecture and Planning, at the closing reception on October 1. The scholarship was presented in the name of Professor Horacio Caminos, one of the initiators of the Settlement Program, and Reinhard Goethert, who had been with the program since 1968."

Alumni officers were elected consisting of **Edward Popko,** M.Arch.'71, of Cambridge (chairman); **Philippe Annez,** M.Arch.'71, of the World Bank, Washington, D.C. (treasurer); and **Robert Parker,** M.Arch.'70, of Nova Scotia (secretary). Officers were also selected from each of the regions of the world."

**C. Herbert Wheeler, Jr.,** M.Arch.'40, writes that he is an FAIA and professor emeritus of architectural engineering at Pennsylvania State University and has been elected to the College of Delegates of the Union Internationale des Architects in Paris, France, as secretary in charge of the education and practice work groups.

## VI

### Electrical Engineering and Computer Science

The celebration of the centennial of electrical engineering at M.I.T., held October 2 and 3, 1982, was a wonderful occasion. Hundreds of alumni/ae, friends, faculty, and students participated in the myriad of special events. A high point on the agenda was the Centennial Banquest held in the new Special Events Center on Saturday evening. Institute Professor (Emeritus) **Harold "Doc" Edgerton,** '27, was Master of Ceremonies and President **Paul E. Gray,** '54 (graduate of VI) was the main after-dinner speaker. An excellent after-dinner speech was also given by **Michael A. Isnardi,** '82, who spoke eloquently as representative of the students in Course VI.

The centennial activities concluded Sunday afternoon with the Special Events Center converted into a carnival atmosphere complete with hot dog stands, balloons, and a huge 1,500-pound birthday cake of which everyone got a piece. Two musical groups performed: a jazz combo organized by Professor (emeritus) **Truman S. Gray,** '29, and "Doc" Edgerton's guitar group. It was a wonderfully informal atmosphere where everyone wandered about talking with friends.

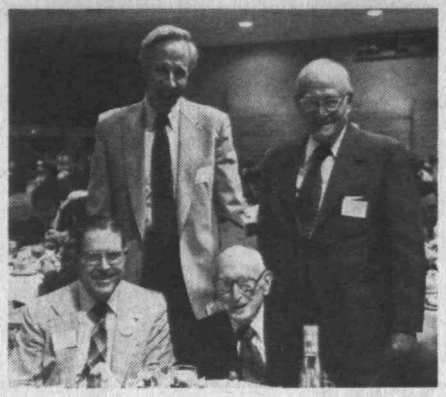
Professor Edgerton was honored last fall by the establishment of a $1 million research endowment in his name at the New England Aquarium, Boston. Income from the fund will support young scientists conducting research at the aquarium, and contributions in Professor Edgerton's honor may be made to the aquarium.

**Mavin L. Minsky,** Donner Professor of Science at M.I.T. who was a founder of the Artificial Intelligence Laboratory, took part in the 1982 Creativity Week Symposium of the Center for Creative Leadership, Greensboro, N.C., last fall as the 1982 Bendix Innovation Fellow.

**Erich P. Ippen,** '62, professor of electrical engineering at M.I.T., was named joint recipient with Charles V. Shank of Bell Labs of two awards for their work in electrical measurements late last year: the Edward Longstreth Medal of the Franklin Institute of Philadelphia for work with subpicosecond optical pulses; and the Morris E. Leeds Award of IEEE for measurement technology in the sub-picosecond range.

**Norman Doelling,** S.M.'55, who has been manager of the M.I.T. Sea Grant Program's Marine Industry Advisory Service Collegium, is now executive officer of the M.I.T. Sea Grant College Program. The collegium, designed to bring Sea Grant findings and services to ocean related industry, grew from 15 to over 100 members since

*Reunion within a reunion. No one who studied in Course VI-A seems ever to forget the experience–and most of them pay tribute to Karl L. Wildes, '22, for his long-time stewardship of the program. This picture, made during Course VI's Centennial Banquet, shows Professor Wildes with John A. Tucker, present VI-A director, and John G. Linvill, '43, and Cecil H. Green, '23 (standing, left and right).*



Mr. Doelling helped establish it in 1975.

**John G. Trump,** Sc.D.'33, professor of electrical engineering, emeritus, at M.I.T. who pioneered the use of megavolt x-ray devices for cancer therapy as director of the High Voltage Engineering Laboratory, now holds the gold medal of the American College of Radiology, that organization's highest honor for achievement in the field. The citation was for "most significant contributions to capabilities in cancer radiotherapy."

**Adolf F. "Sonny" Monosson**, '48, is a professional DEC (Digital Equipment Co.) watcher, publisher of the *Monosson on DEC* newsletter, as well as proprietor of the pioneering American Used Computer Corp. And it's a special time for DEC-watchers, Mr. Monosson wrote late last year, for as the company enters the personal computer field it will have to shift its sales effort from low- to high-key. Profit-and-loss responsibility is being moved from DEC's "formerly powerful product groups to its sales organizations," wrote Mr. Monosson—DEC's "most sweeping reorganization since . . . the 1970s." Another DEC-watcher, **Stanley Klein**, '58, confirmed the trends in a report to *The New York Times*, noting that the company founded by **Kenneth H. Olsen**, '50, soon "will have to square off against some hungry and technologically aggressive contenders." But DEC's founder wouldn't admit to concern: "The marketplace for computers is infinite," Mr. Olsen told Mr. Klein late last year.

**A. Edward Profio**, '53, professor of nuclear and chemical engineering at the University of California in Santa Barbara, has led a group of colleagues in the design of a fiber optics device—a fluorescence bronchoscope—which can detect lung tumors when they are only a few cells thick. A bronchoscope is a long flexible tube with a light source at the end which permits visual examination of lung tissue when inserted down a patient's throat. Addition of fluorescence makes possible detection of tumors.

**Arthur Bisberg,** S.M.'57, has been promoted from division manager to senior vice-president and group executive at EG&G, Inc., Wellesley, Mass. . . . **Charles Rich,** Ph.D.'80, is currently a research scientist at the M.I.T. Artificial Intelligence Laboratory. . . . **Peter Hagelstein,** Ph.D.'76, writes, "Still in Livermore. It's nice to be done!" . . . **Mac E. VanValkenburg,** S.M.'46, has been appointed the first Grainger Professor of Electrical Engineering, occupying the only endowed chair in the College of Engineering at the University of Illinois, Champaign. A member of the faculty since 1955 (except from 1966 to 1974 when he served as professor at Princeton University), he is author of several books and scores of research papers, and he has received the Lamme Medal, the highest honor of the American Society for Engineering Education.. . . **Raymond S. Tomlinson,** S.M.'65, is currently a principal in the firm of Bolt Beranek and Newman, Inc., Cambridge, Mass.

Captain **Harold T. Hendrickson,** S.M.'56, of Seattle, Wash., passed away on August 28, 1982; no details are available.

## VI-A Program

An extremely interesting exhibit entitled "A Bunch of Electricals: An M.I.T. Electrical Engineering Retrospective," was put together by the M.I.T. Musuem and ran concurrently with the centennial celebration (*see above and page A6*) in the Margaret H. Compton Gallery. VI-A was covered by a section on Professor William H. Timbie, VI-A director from the summer of 1919 until his June 1947 retirement. A metal plaque of the old Hexalpha organization, along with its charter, was also part of that display.

From the checklist of preregistrants, plus those John Tucker met personally, here is a partial list of VI-A's alums who came to the centennial activities: **Jerome L. Abel,** '60; **Richard B. Adler,** '43; **John R.M. Alger,** '49; **C. Gordon Bell,** '56; **Eugene Y. Chang,** '76; **Arthur C. Chen,** '61; **Joseph P. DiLiberto III,** '70; **Alvin W. Drake,** '57; **Paul R. Drouilhet, Jr.,** '37; **Ronald B. Goldner,** '56; **Bernard M. Gordon,** '48; **Cecil H. Green,** '23; **Charles T. Greene, Jr.,** '56; **Holton E. Harris,** '44; **Curtis P. Hartwig,** '61; **Daniel R. Helman,** '80; **Charles Heiken,** '51; **Thomas D. Higgins,** '49; **Thomas C. Horth,** '57; **Michael A. Isnardi,** '82; **Lori F. Lamel,** '79; **Nilo A. Lindgren,** '48; **John G. Linvill,** '43; **Alan Lukas,** '72; **Taskashi Mitsutomi,** '52; **Frederic R. Morgenthaler,** '55; **William E. Northfield,** '56; **Alan V. Oppenheim,** '59; **Robert B. Parente,** '58; **Charles C. Perez,** '56; **Winthrop F. Potter,** '22; **Edward M. Pritchard,** '30; **Howard L. Richardson,** '31; **Allan C. Schell,** '55; **Raymond S. Stata,** '57; **David D. Terwillinger,** '35; and **David F. Tuttle, Jr.,** '37.

**Winthrop F. Potter, Jr.,** '22, who also happened to be Director Tucker's boss while he was with the New England Telephone Co. back in the early 1950s, was probably the earliest VI-A class attendee at the centennnial. He was a member of VI-A's second class.

NASA has announced that scientist/astronaut **William B. Lenoir,** '61, will be mission specialist aboard Shuttle 5 which may already have flown by the time this appears. Dr. Lenoir did his VI-A work at the General Radio Co. and served as an instructor and assistant professor in the department before joining NASA.

Several VI-A alumni who were on campus this fall interviewing for their companies contacted Director Tucker: **Johnny Low,** '78, for MITRE Corp., **David E. Meharry,** '71, for Sanders Associates, **C. Timothy Kuo,** '81, for Watkins-Johnson, Gaithersburgh, Md., and **S. Dana Seccombe,** '70, with Hewlett-Packard, Ft. Collins, Colo., Hewlett-Packard recruiting team leader.

Seen at the on-campus career fair sponsored by the Society for Women Engineers representing GenRad was **Kenneth M. MacKillop,** '81. That highly successful fair was organized by our own **Peggy A. Pescatore,** '83, who's currently doing her VI-A work at Motorola, Schaumburg, Ill.

On October 11, Mr. Tucker was invited to join a group of VI-alumni, their wives and guests for dinner at Ephraims, Sudbury, Mass. Included were **Geoffrey J. Bunza,** '74, **Bradford E. Hampson,** '75, and **Lawrence Kernan,** '75.

Dropping in during an October east coast visit was **Mark T. Fuccio,** '80. Mark is now with Trilogy Systems Corp., Cupertino, Calif., and lives in Santa Clara. . . . A letter from **John D. Chisholm,** '75, says he has left Hewlett-Packard and is now working for Grid Systems in California's Silicon Valley. . . . **Allen K. Wells,** '80, keeps in touch and tells us he is now with General Computer in Kendall Square, Cambridge, Mass. . . . A telephone call from **David L. Lyon,** '69, informed Mr. Tucker that he has taken a position with Linkabit, Inc., San Diego, Calif. He also mentioned that **Andrew J. Viterbi,** '56, has moved up to the presidency of Linkabit, a company with many M.I.T. graduates.

Another announcement is that **Robert C. Fulks,** '58, has sold his firm, Micro Systems, Inc., Phoenix, Ariz., to GenRad. It's interesting to note that Bob did his VI-A work with the General Radio Co. (which later became GenRad). . . . **Joseph L. Healey,** '77, visited us from the Washington, D.C. area. Joe and two other of his VI-A colleagues from Naval Surface Weapons Systems days, **Jeffrey J. Held,** '76, and **David Passmore,** '77, work for Network Strategies, Inc., whose president is **Charles C. Joyce, Jr.,** '56. This is a consulting firm in the area of data and telecommunications.

A call from **Theodore T.S. Wong,** '73, brought news that he is now associate director of Engineering Career Associates, Burlington, Mass., which also has a new office in Wellesley, Mass.

The annual meeting of the Corporation Visiting Committee for the department was held at M.I.T., November 15 and 16, 1982. Of the 27 distinguished members of the committee, all people of high achievement, it is significant to note that six are graduates of the VI-A Program: **A. Paul L. Hotte,** '42 (Corporation member); **Joseph F. Keithley,** '37 (chairman, Keithley Instruments, Inc.); **John G. Linvill,** '43 (former head, Electrical Engineering Department, Stanford University); **Lawrence G. Roberts,** '59 (president, DHL Worldwide Courier Express); **Raymond S. Stata,** '57 (president, Analog Devices, Inc.); and **William R. Thurston,** '43 (president, GenRad, Inc.).

Visitors to the VI-A office since the last writing, in addition to those mentioned earlier, have included: **Arthur C. Chen,** '61, with corporate research and development, General Electric Co., Schenectady, N.Y.; **Leonard N. Evenchik,** '77, with Bolt Beranek and Newman, Cambridge, Mass.; **Michael A. Gennert,** '79, who has returned from General Electric Co., Pittsfield, Mass., to do further graduate work; **Michael Moncavage,** '82, with Schlumberger; **Lynn M. Roylance,** '72 with Hewlett-Packard Laboratories, Palo Alto, Calif.; and **Ronald P. Troutman,** '62, with IBM Corp., Essex Junction, Vt.—John A. Tucker, Director VI-A Program, Room 38-473, Cambridge, MA 02139.

# VIII

## Physics

The second of two professorships in physics at M.I.T. established by Cecil H. Green, '23, and Ida Green has now been awarded to Robert J. Birgeneau, who came from Bell Labs to be professsor of physics at M.I.T. in 1975. A graduate of the University of Toronto (B.Sc. 1963) and Yale (Ph.D. 1966), Dr. Birgeneau is a specialist in the phase-transition behavior of novel states of matter; he is considered a leader in the field of condensed-matter physics. The Greens' first physics professorship is held by Herman Feshbach, Ph.D.'42, head of the department.

# X

## Chemical Engineering

**Burton B. Crocker,** S.M.'47, an engineering fellow in the Corporate Engineering Department of Monsanto Co., St. Louis, Mo., has received the

Environmental Division Award from the American Institute of Chemical Engineers. His acceptance speech at AIChE's summer meeting in St. Louis dealt with his personal approach to air pollution control and several basic principles which can be applied to industrial emissions control.

**Warren Campbell Nelson,** S.M.'34, a retired quality control expert for Sunkist Growers, Inc., Ontario, Calif., passed away on June 30, 1982. Among his many affiliations, he was past president of the Ontario Host Lions Club and currently president of the Pomona Valley Community Concert Association, was active in the Valley Community Theatre and the Foothill Oratorio Society. . . . **Albert L. Schulerud,** S.M.'34, of Nutley, N.J., passed away on July 10, 1982, following a heart operation.

# XIV

## Economics

The third edition of *Quality Control* (New York: McGraw Hill Book Co., 1982, $39.50) by **Armand V. Feigenbaum,** Ph.D.'51, is described by its publisher as "a major revision, thoroughly updated, of the pre-eminent work in the field." Dr. Feigenbaum is president and chief executive officer of General Systems Co., Inc., and is credited with "an approach to quality and productivity that has profoundly influenced the competition for world markets . . . throughout the industrialized world."

**James D. Hess,** Ph.D.'75, has been appointed visiting associate professor of economics at Claremont McKenna College, Claremont, Calif. Prior to this appointment he had taught courses in both macro and microeconomics at M.I.T.

# XV

## Management

A prize of $7,500 for the outstanding graduate student in the Sloan School has been established by Lewis E. and Therese S. Seley, and its first award has been made to **Edward M. Hancock,** S.M.'82, who is now with General Motors Corp. There will be annual awards hereafter, according to Dean Abraham J. Siegel.

**Philip A. Stevens,** S.M.'58, is currently vice-president—administration of the National Machinery Co., Tiffin, Ohio, a designer and manufacturer of hot and cold forging machinery. He is a registered professional engineer and is listed in *Who's Who in Engineering*. He holds two awards from Ohio State's College of Engineering—in 1973 the Texnikoi Alumnus Award and in 1976 the Distinguished Alumnus Award. . . . **John F. Fort III,** S.M.'66, a senior vice-president of Tyco Laboratories, Inc., has been elected a director of Heinicke Instruments Co., Hollywood, Fla.

**Walter C. Hinds, Jr.,** S.M.'62, senior vice-president of GenRad, Inc., Concord, Mass., has been named to the additional post of general manager of the firm's Futuredata Development Systems Division, a maker of computerized tools used in the design of microprocessor chips. . . . **Marvin Campen,** S.M.'48, reports that he has been "(semi)-retired as of May 31, 1982 from business manager—synthetic fuels, Gulf Oil Chemicals Co., Houston, Tex., with 'consulting agreement' with GOCHEM. I am now living with Mrs. C. in an 165-year-old 2-story log house, where my great-great-great grandfather and grandmother raised 21 children," located in McMinnville, Tenn.

**Erskine N. White, Jr.,** S.M.'49, president of E.N. White Management Corp., has taken on the additional post of director of McCormick & Co., Inc., Hunt Valley, Md. . . . **Richard S. Bodman,** S.M.'61, is currently president of the Satellite Television Corp., a unit of Communications Satellite Corp., Washington, D.C.

## Sloan Fellows

**Rita A. O'Brien,** S.M.'77, vice-president for Rhode Island of New England Telephone and Telegraph Co., has been elected to the M.I.T. Corporation. She is also a member of the Board of Overseers of Whitman College, a director of the Council of the Boston Museum of Fine Arts and the Rhode Island Philharmonic. . . . **Philip B. Fletcher,** S.M.'70, formerly vice-president of manufacturing for the Spirits Division of Heublein Co., was named president of Banquet Foods Co., a subsidiary of ConAgra, Inc., Omaha, Neb., a commodities and agricultural products concern. . . . **Goff Smith,** S.M.'53, has retired as chairman of Amsted Industries, Inc., after more than 35 years of service with the company; he had been Amsted's chief executive from 1974-81.

**William E. Cotter, Jr.,** is currently president, Energy Group, at the National Steel Corp., Pittsburgh, Penn. Prior to this, he was president, National Mines Corp., a subsidiary. . . . **Carl H. Janzen,** S.M.'74, has been appointed vice-president and group executive of the Business Machine Group of Burroughs Corp., Detroit, Mich. . . . **David A. Lewis,** S.M.'67, has been promoted from executive vice-president to president of the Continental Bank of Canada, Toronto.

**Peter S. Hepp,** S.M.'68, former group vice-president of Sun Co., is currently group vice-president of UNC Resources, Falls Church, Va. . . . **John J. Wetzel II,** '73, has been appointed chief engineer for Pontiac Motor Division, Pontiac, Mich. John has been assistant chief engineer for Pontiac's powertrains and chassis since February 1979. . . . **Kenneth A. Charon,** S.M.'66, has returned from Paris to be group director of operations planning for the Information Systems and Communications Product Group, IBM Corp., White Plains, N.Y.

**David D. Moffat, Jr.,** S.M.'41, of Salt Lake City, Utah, passed away on January 6, 1982; no details are available.

## Joint Program in the Management of Technology

**Elliot S. Blackman,** S.M.'81, is currently with NEC Electronics U.S.A. as project manager in digital systems processing. He is in their microcomputer division, Natick, Mass., and continues to live in Chelmsford. . . . **Richard H. Bullen,** S.M.'82, is living in Hastings-on-Hudson, N.Y., and has joined the Bullen Management Co. as a partner. His wife, **Christine** (S.M.'76, Sloan School master's program), is making the commute to the Sloan School where she continues as assistant director of the Center for Information Systems Research. . . . **Henry M. Montrey,** S.M.'82, has been named lumber technology manager at Weyerhaeuser Co., Tacoma, Wash. He says he hopes to be coming to the Boston area for a visit this spring.—Jane Morse, Program Manager, Room E52-533, M.I.T., Cambridge, MA 02139.

## Technology and Policy Program

**Loren Hall,** S.M.'79, is working for the Office of Toxic Substances (EPA) in designing the graphical exposure modelling system (GEMS), which will perform exposure analyses for new chemicals as required by the Toxic Substances Control Act. . . . **Brian Mellea,** 'S.M.77, has a new position with CSI Resource Systems. He performs technical and financial analyses of waste products, with emphasis on alternative fuels.

**Bob Desourdis,** S.M.'80, is a communications scientist with Science Applications, Inc., and is involved with communications network design and studies of electromagnetic propagation in perturbed environments. . . . **Clint Stanovsky,** S.M.'81, is an economist with $CH_2M$ Hill in Washington state, involved with project economic and financial feasibility studies for a variety of energy and resource projects.—Professor Richard de Neufville, Chairman, Room 1-138, M.I.T., Cambridge, MA 02139.

# Classes

## 14

**Alfred D. Chandler** died at the age of 90 on September 13, 1982, at his home in Wilmington, Del. While he was a senior at Harvard, from which he graduated in 1914, he took courses in mechanical engineering at the Institute. After front-line service in World War I, he was a manager for the Baldwin Locomotive Works in Cuba and in Argentina, and then was chief of its South American desk. Later he was an officer of the Bellanca Aircraft Corp., of New Castle, Del. Mr. Chandler was a long-time member and an officer of the Nantucket Yacht Club and a member of the M.I.T. Club of Delaware. He is survived by his wife of 65 years, Caroline (Ramsay), two sons, three daughters, 21 grandchildren, and 13 great-grandchildren.

**Albert C. Sherman, Jr.,** died on August 3, 1982, at the age of 90, in a hospital near his home in Newton Highlands. In the early part of his career he lectured on music at Boston University and was a music teacher at the Longy School in Cambridge. Later he taught at the Boston Conservatory of Music and eventually became its dean. After retiring from teaching, he was for nearly 20 years the librarian of the Harvard Musical Association in Boston. Albert was a member of that association, as well as the Appalachian Mountain Club, the Old Dartmouth Historical Society and the Boston Mycological Society. He is survived by three daughters: Hannah Sherman, of Newton Highlands; Elizabeth Lader, of Orleans; and Margaret Kohn, of Claremont, Calif.; five granddaughters, and a great-grandson.—**Charles H. Chatfield**, Secretary, 177 Steele Rd., West Hartford, CT 06119

## 15

I had a real surprise when I received a letter from **Herman Morse**, stating that he and his wife Marge are carrying on nicely and asking me if I would attempt to get together some statistics on this class supreme. Then I drove out to visit my niece and her family, in Kankakee, Ill. There surely are cornfields, as you well know, and I decided to go for a ride on her husband's bike. I actually had some misgivings when I took it out of the garage. It was much too big, and I immediately decided to get off but in so doing tripped myself, fell to the pavement, and badly broke one hip. Six weeks have now past. It is mending beautifully, but the doctor says six more weeks of crutches. So, by the time you read this, Fifteeners, I hopefully, will be completely recovered! Anyway, Herman, I am now back in circulation and intend to see what information I can get from the Alumni Office.

A sympathy card from **Mary (Mimi) Plummer Rice** states that there were originally 325 in the Class of 1915. She and **Alton Cook** graduated from Dorchester High School in 1911 and went on to M.I.T. She lived 60 years in Bronxville, N.Y., and remembers how she and Alton both attended the 1915 class reunions. Recalling how gentle and courteous he always was, she says she will miss him next June when she returns for the 68th Reunion. She also mentions that only five Fifteeners attended in 1981, and I have already advised you that **Evers Burtner** was the only classmate present in 1982. So, let's aim high, fellas, and have as many of the gang as possible present this coming June.

I trust you all survived the holidays beautifully, and now is the time for good old man winter to show us who is boss! PLEASE DROP ME A LINE!—**Joyce E. Brado**, Class Agent, 491 Davison Rd., Apt. 9, Lockport, NY 14094

## 16

Talked with Grace and **Dan Comiskey** and both are well after enjoying a good summer. . . . **Barney Gordon** sounded hale and hearty over the phone. He had a busy fall attending weddings of a couple of his grandchildren. . . . Sibyl and **Ralph Fletcher** again were in Canada for the mid-September opening of their duck-shooting season. Ralph continues to be active in his granite business although spending less and less time in his office.

We regret to report the sudden death of Frieda (Mrs. **Hy) Ullian** on October 29, 1982, and of **Leonard Besley** on July 19, 1982. May they rest in peace.

Keep eating, drinking, walking, breathing, everything in moderation. And yes, of course, keep writing.—**Ralph A. Fletcher**, Acting Secretary, Groton Rd., West Chelmsford, MA 01863

## 17

Colonel **Walter Medding** died on June 16 in Springfield, Vir. He had been commissioned in 1917 as an ROTC graduate of M.I.T. and subsequently served 18 months in France with the American Expeditionary Force. After returning from France he accepted a commission as first lieutenant in the regular army. During the next 20 odd years he rose to the rank of major while he was serving in various assignments in the United States. He was promoted to lieutenant colonel in 1940 and to colonel in 1942. After serving in various responsible assignments in North Africa, Italy, and Japan, as well as the United States, he retired in 1953.

**Ray Brooks** recently told us that in May 1981 he had had a cataract operation with plastic implant in his left eye, and in March 1982 he had a similar operation in his right eye. Unfortunately, his problem had not been adequately diagnosed, and last September a different ophthalmologist was giving him treatment for glaucoma in both eyes. Subsequently, he anticipated a laser operation to eliminate a blind spot in his retina. We all wish you well, Ray. . . . In September Alice and **Will Neuberg** flew for a month's visit in Germany. . . . In September Christine and I returned from a five-weeks' stay in Southwest Harbor, Maine by way of Concord, N.H. so that we had the pleasure of seeing Jeanette and **Stan Dunning** in their nice retirement community.—**Walter J. Beadle**, Secretary, Kendal at Longwood, Box 217, Kennett Square, PA 19348

## 18 65th Reunion

Your secretary attended the initial meeting of the M.I.T. Cardinal and Gray Society at Endicott House in October—a luncheon followed by an afternoon with Howard Johnson, who gave an interesting talk and showed nostalgic slides on the history of M.I.T. An enthusiastic gathering of alumni, with their spouses and some widows, broke bread together and exchanged greetings and reminisced. The genesis of this occasion begins with the class of 1918. You will recall our annual mini-reunions at Endicott House, starting after our 50th Reunion. As the years went by our numbers decreased, so we added participants from the classes near ours to maintain a reasonable quorum. With our members still dwindling, I suggested two years ago enlarging the group to include all classes out more than fifty years. The first meeting was a modest 50; last May we had more than 90; in October, with 150, we used all the space—and then some!—available at Endicott House.

A recent Gallery Talk at Smith College Museum of Art brings back memories of interest to us. Christine Swenson spoke on "Craftsmanship and Eloquence in the Work of Two American Masters: **John Taylor Arms** and **Samuel Chamberlain**," and the museum's Print Room displayed an exhibition of etchings by Arms and drypoints by Chamberlain from the museum's collection. There are striking similarities in the lives and careers of these two artists. They studied in the School of Architecture at M.I.T. in the early 1900s and served in World War I, during which their exposure to European architecture had a tremendous impact on each of them. Arms had begun etching as a hobby in 1913 while working for a New York architectural firm, but by 1919 he was devoting all his energies to the art. Chamberlain began experimenting with lithography, etching and drypoint while on a sketching tour of Europe after the war, and he soon became a proficient and prolific printmaker. Both artists, but particularly Arms, enjoyed considerable reputation and prestige during their lifetime.

We note with sorrow the deaths of three class members: **Wallace Neff** died on June 10, 1982. He studied architecture at M.I.T., and went on to become a leader in the development of Southern California's early architectural style, and a pioneer in the creation of mass-produced "bubble" structures. He helped create the style of architecture of the 1920s and 1930s, and his style was widely imitated through the 1940s. . . . **John W. Clarkson** died on August 14, 1982. He was a veteran of World War I, serving as a second lieutenant in the Army Air Service. For 40 years, he was a production planner with Hood Goodrich Rubber Co. in Watertown, retiring in 1960. . . . A

*The 1982 Bronze Beaver to John L. Riegel, '19 (left), from Denman K. McNear, '48, president of the Alumni Association. "One of our most effective and conscientious volunteers, . . . working quietly behind the scenes, he has contributed immeasurably to M.I.T.'s long-term contacts with government, industry, and foundations. . . . A very special M.I.T. alumnus."*

note from Charles Burke, '23, tells of the death of his brother **Francis C. (Frank) Burke** on June 20, 1982. He graduated from Course IV, and practiced architecture actively all his life. With intervals of private practice, he was associated with a number of Boston offices, most recently Leland and Larsen, at the time of his retirement. He was a member of the American Institute of Architects and the Boston Society of Architects.—**Max Seltzer**, Secretary, 1443 Beacon St., Brookline, MA 02146; **Leonard I. Levine**, Assistant Secretary, 519 Washington St., Brookline, MA 02146

# 19

Seeking news items of the class from several mates, I made some telephone contacts and found each well and busy enjoying various degrees of retirement but without much news to report. It was good, however, to talk to them.

It is a relief to have no deaths to report this issue. However, I do have now some particulars on **Donald Kitchen**, whose death I reported last time. Don graduated from M.I.T. with a degree in chemistry. He served in the Signal Corps during World War I. He worked for the Fixed Nitrogen Laboratory of the Department of Agriculture from 1921 until 1925. He later worked for the Arthur D. Little Co. of Cambridge as a research scientist and for the Research Laboratory for Applied Chemistry at M.I.T. He later became senior scientist for Simplex Wire and Cable Co., until he retired in 1963. He leaves his wife Evelyn (Swett); three sons, Donald W. Jr., Charles E., and Robert M.; six grandchildren; and four great-grandchildren. A great fellow and a credit to our class.

**Frederick Spooner** comments, after a leg amputation, "I am a poor prospect for the class reunion." . . . **Morton Smith** writes, "My replies to plans for the 60th Reunion never made it to class notes in the *Review*, so decided they were not needed." (Sorry, Morton, we are doing better now and would like to see you at the 65th.) . . . From **Jim Strobridge**, "Still pumping along with a pacemaker." (Great. Perhaps you will make the 65th.) . . . And from **Martha Taylor**, "Well, but not active enough to attend the reunion." . . . **William Voght**, "Better since my gall bladder operation last summer." (Hope you will be able to be with us.). . . "In the best of health," writes **Holly Winkfield**. (We'll surely look forward to your presence.). . . And from **Leon Snow**, "Whether I attend will depend on when the reunion is held, as I visit Boston area but twice a year." (We'll keep you posted.)

As you can see, your classmates read these notes and enjoy hearing about you. Just drop me a few lines, and I'll pass it on to all the other '19ers. Happy New Year.—**W. O. Langille**, Secretary, Box 144. Gladston, NJ 07934

# 20

**Edward R. Cruise** of Stoughton, Mass. died June 22. He was retired from the management of Boston Woven Hose and Rubber Co. He lived in Lynn before moving to Stoughton some years ago. He is survived by his wife, four daughters, and five grandchildren. . . . Also regretted is the death of **Dave Kaplan** of South Palm Beach, Fl. on September 9. Before retiring to 3576 South Ocean Dr., he was owner and manager of Morris Kaplan and Sons, jewelers, in New York City. An ardent and enthusiastic traveler, he visited most of the European countries. He is survived by his wife Evelyn and a daughter.

At this writing we are looking forward to a meeting of the Cardinal and Gray Society, which consists of classes graduating 50 years ago or more, at Endicott House in Dedham. There will be a luncheon and an opportunity to listen to a discussion on business and the current economy by none other than the distinguished chairman of the M.I.T. Corporation, Howard W. Johnson. We are hoping to be joined by several classmates as we were on the last occasion. See next month's *Review* for a report on this pleasant gathering. And have a good winter.—**Harold Bugbee**, Secretary, 21 Everell Rd., Winchester, MA 02890

# 21

Betty and I are just back (mid-October) from a two-week trip to California, with a class notes deadline staring me in the face. We spent three days in Yosemite Park, did some walking, saw the giant redwoods, and thoroughly enjoyed the magnificent scenery. We were visiting relatives the whole time but took time out to call on Marianne (Mrs. **Grant) Miner** in Los Altos. She was in fine spirits even though she has to use a walker because of disc trouble in her spine.

Congratulations are extended to **Helier Rodriguez**, who received the Bronze Beaver award at the October Alumni Officers' Conference in Philadelphia in recognition of his long and loyal service to M.I.T. Helier has been president of the M.I.T. Clubs of Cuba and Tampa, Fl. He organized and ran a most successful interim reunion in Cuba. He and Graciela drove up from Florida to attend the conference. Maxine and **Cac Clarke** also attended, and Cac sent out a letter to a number of classmates in hopes of having an interim class reunion there. As a result, **Robert W. Barker** attended with his son, and **Roy Snyder** came with his wife Ida. Helier has agreed to be the host for another interim reunion of the class at the M.I.T. 1983 Florida Festival to be held in March 1983.

Marion (Mrs. **George) Clutter** sent me an early Christmas card to tell me she is leaving Cape Cod about November 15, 1982, and her new address will be Carleton Village, B15, 100 Old Billerica Rd., Bedford, MA 01730. This is a retirement complex four miles from Lexington, out in the country. Marion writes she will be near **Winnie Wood Foss** and looks forward to seeing her. . . . A note from **Horace Tuttle** of Bloomfield, Conn. sends autumn greetings. He and his wife Pearl had hoped to attend the World's Fair in Knoxville with his senior citizen musical group where they were asked to put on a variety show. For health reasons they couldn't make it. . . . In a phone call to **Cac Clarke** I learned that Leila and **Sam Lunden** had taken a trip to Nova Scotia. Cac also said that Anne (Mrs. **Wallace) Adams** had phoned and said she was doing fine. . . . A clipping from the August 11, 1982 *Norwell Mariner* tells how **Chester Rimmer** back in the early sixties was author of a plan to expand Cushing Memorial Town Hall. The plan was shelved but an engineering firm is now studying space needs and costs to expand and remodel Cushing Memorial. Following Rimmer's retirement at age 58 as a manufacturer, he entered town government service and served for seven years as a selectman.

We are saddened to report the death of **Larcom Randall** of Sarasota, Fla. on August 23, 1982. Larc had extensive leg surgery in the last few years and had to get about in a wheelchair. Every year in Florida, your secretary has enjoyed calling on him because he was full of fun in spite of his health problems. Larc was the owner of the Larcom Randall Advertising Agency in Boston. He was an ensign serving on a submarine in World War I. The class extends sympathy to his wife Katharine. We shall miss him.—**Sumner Hayward**, Secretary, 224 Richards Rd., Ridgewood, NJ 07450; **Josiah D. Crosby**, Assistant Secretary, 3310 Sheffield Cir., Sarasota, FL 33579; **Samuel E. Lunden**, Assistant Secretary, 1149 S. Broadway, Suite B-800, Los Angeles, CA 90015

# 22

First, your secretary must correct an omission in the October 1982 notes. **Fearing Pratt** was very much in evidence at the 60th Reunion, to the pleasure of his classmates.

Additional word about **Warren Don Sherman**, whose death was noted last issue. Born in 1894, he was considerably older than most of us. Before coming to Cambridge, he graduated from Hillsdale College in Michigan to enter M.I.T. in his sophmore year. During the first world war, he served with the 148th Ambulance Company in France; he was a 32nd Degree Mason and a member of the Sons of the American Revolution. He was an executive of Mobil Corp., retiring about 1960. His fraternity was Delta Tau Delta, where he was in the company of such outstanding but now deceased classmates as **Al Browning, Larry Davis,** and **Heinie Horn.**

The following about **Fay Osborne**, who died last February in Florida, is of interest. In 1930, early in his 40-year career with C.H. Dexter and Sons of Windsor Locks, Conn., he developed a special paper-making process which made possible the invention of the teabag. Osborne was known as the "Edison of the paper industry." Dexter became the leader in the teabag market. "It was a little old wrapper around a cigar that got me started," Osborne said in 1979 when he returned to Dexter for the dedication of the company's research and development center. In retirement, he was a member of the Lake Sunapee (N.H.) Yacht Club, the Sunapee Historical Society, and the North Palm Beach Country Club.

**Ab Johnson**, our bon vivant unattached elder statesman without portfolio, went off on another trip to Europe last August, this time on a Phoenix Art Museum tour, with principal stops at Venice and Paris. He is helping to minimize the Concorde deficit.

**Carl Bjorn Braestrup** died August 8, 1982 at age 85 in Middletown, Conn. of a stroke. Born in Copenhagen, he came to the U.S. in 1918 and entered M.I.T. as a junior. The following is taken in large part from the *New Haven Register* of August 11, 1982. From 1929 to 1966, Braestrup was director of the physics laboratory of the New York City Department of Hospitals. During World War II he joined the Columbia University research team of the Manhattan Project, his work dealing with the radiological health aspects. After the war, he was consultant at the atomic tests at Bikini Atoll and later consultant to the Atomic Energy Commission, the Oak Ridge Institute for Nuclear Studies, and the Surgeon General of the Army. He was also the inventor of the Theratron, the first rotating isocentric cobalt therapy machine used in treating cancer. In 1958 he was the joint author of *Radiation Protection*, the first major book on the subject and was the author of more than 50 articles on radiation protection. His 1958 recommendations for federal regulation of X-ray emis-

sions from home TV sets, adopted here and abroad, are still in force. He is survived by his wife, two children, and five grandchildren to whom we extend our appreciation of a worthy classmate.—**Yardley Chittick**, Secretary, Box 390, Ossipee, NH 03864

# 23 60th Reunion

**Dave Joy** writes from Sarasota that while in Connecticut last summer he saw **Fred Almquist**, who plans to attend our 60th, as well as a number of other classmates in Sarasota. . . . Your secretary/treasurer was pleased to receive a copy of the first volume of **Norm Weiss**' *Memoirs*. . . . **Helen Whitaker**, widow of **Uncas Whitaker**, died on September 14. Several years ago we elected her an honorary member of our class, and we were looking forward to having her at our 60th Reunion. She and Uncas were generous benefactors of the Institute, the details of which have been reported in the *Review* and elsewhere. Their most recent contribution was the establishment of the Whitaker College of Health Sciences, Technology and Management, and the Medical Department Health Services Center. The buildings for the college and the center involved the largest single construction project undertaken at the Institute since the construction of the original buildings in 1916. Whitaker College will be the subject of a talk by Professor Ernest G. Cravalho at the first meeting of the Alumni Council for the 1982-83 academic year.

**Alfred Schneider** died in July 1980. While at the Institute he studied subjects in mechanical engineering. We have no information on his career.—**Richard H. Frazier**, Secretary/ Treasurer, 7 Summit Ave., Winchester, MA 01890

# 24

Following our July notice of **Ed Hanley**'s death, we are pleased to report a fine tribute to Ed as set out in a Duquesne University release. It announced that the University's new $4 million School of Law facility would be dedicated as the Edward J. Hanley Hall in memory of "the late prominent Pittsburgh civic leader, industrialist, and University board member." Naming the new law building in Ed's honor was made possible by a $1.5 million gift from Allegheny International, Inc. Allegheny International is the successor to the various companies consolidated by Ed's vision and management since 1936. He was deeply committed to civic service and had a special interest in higher education.

Through the appreciated and kind efforts of John C. Parker, '27, brother of **George E. Parker**, your secretary was informed of George's death on August 18, 1982 in Cape Elizabeth, Maine after a lengthy illness. He was very active at the Institute, being a member of seven organizations and general manager of the Musical Club his fourth year. One memorable event occurred during Senior Week at the Senior Picnic in Pemberton: George went swimming without undressing and rode back to Boston drying out in the boat's engine room. After graduating from M.I.T., he studied corporation finance at Brown University. He had a varied career with a number of corporations as a factory manager, general manager, assistant to a president, and director, and ultimately owned a consultant firm doing business here and abroad. He was a charter member of the National Society of Professional Engineers. Even politics took his attention when he served on the city council of Newburyport, Mass. during 1949 and 1950.

The wife of co-secretary **Herb Stewart**, Winnie H., passed away peacefully October 5, 1982, after a short illness in Waban, Mass. She was a Radcliffe graduate and after 1954 biennially made trips to England with Herb to visit his birthplace. She deeply valued her contacts with all of Herb's classmates and their wives made at class reunions.

You received a letter from **Don Moore** in September begging forgiveness for reminding you that our 60th Reunion was only two years away. Don, in reality, is chairman of that hallowed meeting, and **Don Fife**, his deputy, the record to be so noted in the future. He is very appreciative of cards received indicating probable attendance but would like a signature identification.

Our illustrious class president, **Phil Blanchard**, and his good wife Besse recently spent two weeks in the beautiful White Mountains of New Hampshire, before gravitating to the flat area of Pass-A-Grille, Fl. for the winter. They plan to hobnob with Allora and **Clint Conway**, Peg and **Pret Littlefield**, and other area alumni. Happy beachcombing, y'all!—**Russell W. Ambach**, Secretary, 216 St. Paul St., Brookline, MA 02146; **Herbert R. Stewart**, Assistant Secretary, 8 Pilgrim Rd., Waban, MA 02168

# 25

This is an opportune time to suggest that classmates take a few mintues to write a note to the secretary when sending in your annual gift to the Alumni Fund. Other classmates want to hear of your activities.

News of the passing of two classmates has arrived since the last notes were prepared. Belatedly the Alumni Office was notified of the death of **Arthur Brickley Sandford Foale** in Sacramento, Calif. on October 16, 1978. Art lived in Sacramento up to the time he came east to the Institute and, from available records, returned there to reside the remainder of his life.

On February 28, 1982 **Charles Geoffrey Roberts** died in Chelterham, England. Geoff was born in Bulawayo, South Rhodesia, but left there in 1903 and was located in Berkeley, Calif. before entering the Institute. His field was electrical engineering, and he spent most of his working years in the mining field being assistant manager of the Pacific Tin Consolidated Corp. in Kuala Lumpur, Malaya. In 1943 he was married to Constance Hancox from South Africa. Because of his foreign assignments, he made no reunions until the 55th when he and Constance came from England and added greatly to the gathering of classmates. Over the years, Geoff kept in touch by letter with the class secretary, and on one occasion while on vacation he stopped to see me at M.I.T. When he retired he resided for a while on Wildcat Canyon Road in Berkley, Calif but later decided that England was to be his retirement home.—**F. Leroy (Doc) Foster**, Secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

# 26

Your reunion committee has held several meetings to make plans for the proposed mini-reunion in June of this year, and we are now in a position to announce a few preliminary plans which may be modified somewhat depending on the number of classmates and spouses planning to attend. To begin with, there was a consensus among the committee, the class officers, and others consulted that the plans should be on a very modest scale, financially and otherwise, in no way intended to detract from the importance of our regular five-year affair due in 1986. With that in mind it was felt that convenience of location favored Cambridge or Boston and that the time devoted strictly to class affairs should be one day so that we could participate (on an optional basis) in the official M.I.T. alumni programs, as well as other personal visits.

Accordingly, the program calls for registration at the Hyatt Hotel (or alternates to be named) on Thursday afternoon, June 9, with cocktails and dinner followed by bus to Symphony Hall for Tech Night at the Pops, at which a feature will be the M.I.T. song as composed by our own classmate **Bud Wilbur** whom we hope to have with us for the occasion. On Friday we hope to have breakfast together.

*The 1982 Bronze Beaver to Antonio Helier Rodriguez, '21 (left), from Denman K. McNear, '48, president of the Alumni Association. "Before 1960 . . . he was considered by many at M.I.T. to be 'Mr. Cuba.' . . . (Since then) his deep affection and loyalty for the Institute have been demonstrated again in his service to the M.I.T. Club of Tampa Bay. We honor him for a lifetime of invaluable service." (Photo: Philip L. Molten, '55)*

Full details of the program and cards for registration and hotel reservations, rates, etc. will be mailed to you. This will indeed be an opportunity not only for those who have attended previous reunions but also for those who have missed them to see your old classmates and friends again on this 57th anniversary.

We recently received a most welcome note from **Argo Landau** telling us of his finally being able to acquire a copy of the 1926 *Technique* from **Ron Martin**, who had recently offered it in class notes to the first comer. We missed Argo and Edna at the 55th due to an injury to her mother at the time, from which at age 92 (!!) she has fully recovered. The Landaus will be in Hawaii this January for their 25th year. They hope to attend our 57th mini-reunion in June to compensate for the missed one.

Notice of the passing of **John G. Pew** of Dallas, Tex. on July 31 was received from his secretary with no word of his survivors. Also reported was the death of **Robert H. Brunton** on July 22, husband of Gertrude (Stone) and father of Robert S. of Boston and William S. of Avon, Maine. He is also survived by two grandchildren.—**William Meehan**, Secretary, 191 Dorset Rd., Waban, MA 02168

# 27

**Edward A. (Ted) Leach** and Julie have kindly reported on several of his Course VI-A classmates. **Richard Cutts, Jr.** lives in Warwick, R.I. and has had severe physical problems. He retired from General Electric, Co. in 1968 after 40 years—since June 1927—and that is what you call company loyalty. In 1967, the records show Dick was manager for special customer meetings in the New York City office. . . . **Howard O. Woods** and wife Peg live in Wallingford, Vt. in the summer and spend winter months in Scottsdale, Ariz. In 1967 they lived in Exeter, N.H. He has been in management consulting work for a number of years. Recently, he is trying to shed his work load, but he says it's a slow process. . . . The Leachs visited with **George Muchnic** in New York a year ago and enjoyed talking with him. Much, one who went astray from the engineering profession, is in excellent health. After Harvard Business School in 1930, he studied law at Fordham and became a practicing lawyer in New York. He was closely associated with RKO and the movie industry, and after becoming a lieutenant colonel in World War

II, was vice-president of Loews International. He still lives (after 40 years) at 875 Fifth Ave. (you probably own the building, George) and would like to hear from his old VI-A friends.

**Russell Westerhoff** and Katherine in Ridgewood, N.J. have written about joining the celebration of the 50th wedding anniversary of Ruth and **George Copeland** at Peru, N.Y. About 135 family and friends attended the party at their daughter Barbara Perry's home. They enjoy living in their old stone house overlooking Lake Champlain. Our congratulations to you both. . . . **Franklin T. (Hank) Kurt** of South Brooksville, Maine has bluntly expressed himself as having "a hell of a summer." He was under cardiology treatment at Eastern Maine Medical Center for nearly a month. "I was X-rayed, underwent endless tests for my intelligence, if any, and was hitched day and night to a virus drip device that kept me constantly under virus treatment. The hospital finally relased me and listed all their surveys. When it was over I asked, 'Why don't you just tell me I'm 78 and act my age.' They agreed. Louise was nearby at Holiday Inn most of the time and now doles out my keep-alive pills in the correct amount and sequence." Hank, the best remedy is your good humor. Our best wishes to you. . . . **Russell H. Brown** of Falmouth suffered a stroke in September 1979 and is now in Barnstable County Hospital, Pocasett, Mass. Russ was an architect in Boston and Falmouth. He was secretary for the board of directors of the Boston Architectural Club for ten years. He would appreciate a note from classmates.

After an active and illustrious career, **Royal Weller** and wife Betty retired in 1969 and live peacefully in a quiet part of Florida, P.O. Box 226, Yankeetown, FL 32698. He writes, "Betty is blind and I have cancer but we find, even so, life is tolerable. If anyone wants to learn how to catch and eat shark, fight supplyside economics, understand EMP, disapprove of front wheel drive, or become expert in small town politics, just drop us a line." Roy's last assignment was deputy director, NATO Research Center, LaSpezia, Italy, 1966-69. . . . Latest news from **Harold (Bud) Fisher** is that he has gone back to class. He was afraid that computer science was getting ahead of him, so he signed on for a winter course with the younger generation. Good luck, Bud. I need a word processor to improve my notes. Does anyone have one that is easy to punch out?—**Joseph C. Burley**, Secretary, 5 Hutchinson St., Milton, MA 02186; **Laurence B. Grew**, Associate Secretary, 21 Yowago Ave., Branford, CT 06405; **Prentiss I. Cole**, Associate Secretary, 2150 Webster St., Palo Alto, CA 94301

# 28 55th Reunion

With these notes before you it will be the start of a bright new year. So may we begin by wishing all of you good health and happy days ahead! It is also the year in which we celebrate the 55th anniversary of 1928's graduation into the world. By this time you will have received details of the excellent program of our 55th Reunion activities as prepared by your planning committee. Early indications are that it will be a tremendous event, so plan to be there!

Each of us has been asked to write a short composition of a philosophic or sagacious nature based on background, training and/or life experience. We plan to assemble all of these writings into book form. Those who participate will receive a copy of the finished work—it should make fascinating reading. The end result could be an enduring monument to the class and one that might aid, encourage, and inspire newer generations. If you have not yet done so, please prepare your contribution and send it along to **Herm Swartz**.

Speaking of things philosophical, you may recall that five years ago **Jack Rouleau** wrote to us about his earlier day interest in determining true cardinal red color. This effort on Jack's part was done back in 1937 when he was working as an assistant to Dr. Allan Winter Rowe at Evens Memorial Research Laboratory in Boston. Now, after all this time, Jack writes this sequel: "Due to the mores of that era, and as a proper Bostonian at birth, I've avoided disclosing my research topic until now. Times are more liberal now. Rowe had me working on the color reactions of antimony chloride on a family of organic compounds that included the sex hormones. In those days, as you will remember, one used but furtively and only when absolutely necessary the three-letter word *sex*. I found that the female hormones, oestrone, oestradiol, and oestriol, developed a pink color. The male hormone, testosterone developed a blue.

"As you may know, there is no universality regarding choice of color for new babies' wearing apparel. Some parts of the country use pink for boys, blue for girls. Other areas choose the opposite color pattern. So, although my finding back in 1937 afforded a firm basis for a truly scientific choice of color based on sex, as far as I know it has never been revealed to the general public. As I look back on it, perhaps I should have risked being anathematized for science and the peace of mind of young parents and doting grandparents. I don't think President Marsh of Boston University was very impressed by my findings. As I recall, he hardly "hrummpd" when he handed me a small piece of parchment which said in Latin script something about Philosophiae Doctoris."

The Cardinal and Gray Society, consisting of New England area members of the 50-year and older classes (along with widows in those classes), assembled for an outstanding luncheon meeting at Endicott House, October 17, 1982. Representing '28 were: **Hugh Bean**, Marjorie (Mrs. **John A.) Carvalho**, Barbara and **Earl Crawford** , **Bill Hall**, Mary (Mrs. **Arthur A.) Nichols**, Gladys and **Dave Olken**, Dorothy and **Augustus Rogowski**, Janet (Mrs. **John Chamberlain**) Sawyer, Florence and **Walter Smith**. The meeting, with a record attendance of 150, was addressed by Howard Johnson, chairman of the M.I.T. Corporation.

We are very sorry to report that **Vitaly M. Sakouta** died on June 25, 1982. A letter from his wife, Jennie, explained that he had been ill over a period of several years. Vitaly graduated in Course XVI, aeronautical engineering, and earned his S.M. degree in Course XVIII, mathematics. He was an instructor of languages early in his professional career then served with distinction in the U.S. Army during a large part of his active life. He was the recipient of five distinguished service medals earned both here and in Europe. Sympathy of the class has been expressed to Jennie.—**Walter J. Smith**, Secretary, 37 Dix St., Winchester, MA 01890

# 29

About 60 classmates sent their 55th Reunion questionnaire responses to **Jerry Gardner**, general chairman of the forthcoming event. There were a number of suggestions made as to time and place, but the majority of the replies preferred Chatham Bars Inn (the Cape) where we have had our 45th and 50th. As a follow-up to the questionnaire, class president **Bill Bowie**, scheduled a reunion committee meeting on October 22, 1982 at the M.I.T. Faculty Club to discuss and finalize plans. A goodly number attended, as follows: Doris and **Bill Baumrucker**, Sally and **Bill Bowie**, Helen and **Karnig S. Dinjian**, Fran and **Paul Donahue**, **Ruth Fahey**, Joan and **Wally Gale**, **Jerry Gardner**, Mary and **Frank Mead**, Dorothy and Professor **"Fritz" Meissner**, **Ellie Horwitz Sighera**, **Joseph Speyer**, and **Dave Wilson**. The vote of the committee coincided with the majority of the replies—for Chatham Bars Inn. When you read this accounting it will be a little over a year before our 55th, so mark it on your calendar—June 1984.

**John P. Rich** and wife Olive of Nashua, N.H. spent the month of July in their camp at "Golden Pond." He says that movie is playing in Paris but billed as *La Maison du Lac*. They spent August with Helen and **Tom Speller** of Buffalo, N.Y. at Chautauqua. They also took a trip to Ireland with Doris and **Bill Baumrucker** of Marblehead, Ma. in September. John's hobbies are boating, shopwork, gardening, and travel. They have two children and three grandchildren. . . . **Louis F. Southerland** of Austin, Tex. likes to travel, among many other things. Last January, he and his wife Jean took a cruise, sponsored by the Smithsonian Institute, to the Caribbean on the *Sea Cloud*, a beautiful sailing ship. In June he went on an African safari (hunting birds and photographing animals) accompanied by his son. He and his wife Jean are looking forward to attending the 55th Reunion as they did our 50th. . . . **Edward B. Papenfus** of Vancouver, B.C., Canada, says that when he sent a class note to the *Review* in 1980, it brought a visit from George Kloote, '30, which brought material benefit to both of them. He writes, "I continue to enjoy good health, but my wife Gwen is handicapped by poor eyesight. We will winter in South Africa from November 1982 till March 1983."

**Seymour "Cy" A. Baum** sends a note saying, "Many thanks for the birthday greetings. It is so kind of you to remember these dates. Everything is fine with us and I trust all goes well with you. Claire and I send our best wishes." Cy is president of B.H. Aircraft Co. of Farmingdale, N.Y.

Most of us are about 75 years old, give or take a little. If any of you are thinking of heading for a rocking chair for having reached such a rich old age, read what **Walter F. Burke** of Corona Del Mar, Calif. is up to. He writes, "A couple of years ago, I flew my Aztec from Corona Del Mar via Greenland to Germany for a business trip alone. It was a great feeling and sport. I am presently engaged in a new company, manufacturing industrial robots of a revolutionary design which will be selling at $15,000 each with a performance akin to others costing four times as much. I am retired as president of McDonnell Douglas, having been in charge of the design and manufacturing of Mercury, Gemini, and Skylab. I just had my 74th birthday, and I have yet to lose one day of work in my life to sickness. I give thanks and glory to our Lord." His hobbies are, as you might guess, flying his twin Aztec (his own design) and ham radio. He and his wife Pat have one daughter and two grandchildren. . . . **George Crandall** of Caper, Wyo. says "I sold my business, Wyoming Wholesalers, and retired for 90 days. I couldn't stand the inactivity, so I went to work for one of my former competitors in Idaho Falls as a part-time salesman. I travel Monday, Tuesday, and Wednesday each week to and from Idaho Falls. My health is still good, but hearing is getting weak. My wife Willa and I are going to take a trip to Yugoslavia next December (1982). We hope to attend our 55th Reunion. I am going to Connecticut to visit my only surviving aunt on my father's side, who is 90 years old, totally blind, and lives alone. . . . **Richard K. Opper** of Wolcott, Conn. writes, "Last September, I celebrated my 75th birthday with five parties. Not having been married, there is no wife, children, or grandchildren—just cousins in Massachusetts. I enjoyed a two-week trip to California last April, visiting friends in Fresno and San Pedro. I even visited Disneyland, Seaworld, and took in a baseball game involving the L.A. Dodgers. In July, I spent a week on a trip to Danvers, Mass. and Southport, Maine." Richard is involved in community affairs, being on the boards of Wolcott Historical Society, Wolcott Town Committee, and Naugutuck YMCA. His motto is to associate with young people to keep young ideas and ideals alive. He has a close friendly relationship with a neighboring couple who have four children, ranging from 14 to 19 years of age.

I regret to report the death of a few members, **Kenneth C. Blanchard** of Baltimore, Md. on May 4, 1982; **Frank Buckle** of Green Valley, Ariz., April 24, 1982; and **Arthur K. Scott** of Westfield, N.J. on August 19, 1982. Dr. Blanchard left a trust

fund valued at $290,000 with M.I.T. as the sole beneficiary.—**Karnig S. Dinjian**, Secretary, P.O. Box 83, Arlington, MA 02174

# 30

A recent press release reports that **Sieg Linderoth** has been named a fellow of the American Society of Mechanical Engineers (ASME). As many of you know, Sieg has had a distinguished career as a designer of precision mechanical and hydraulic equipment, hyperbaric chambers, and ancillary systems for deep sea operations, as well as a professorship in mechanical engineering at Duke University. In 1980 he was awarded the Centennial Medallion of the ASME Ocean Engineering Division in recognition of both his achievements in designing hyperbaric chambers and his services to the division as organizer of technical symposia. . . . **Jim Biggane** and his wife Ruth are enjoying their retirement in the Palm Springs area amid a number of distinguished neighbors. He says that "over the fence lives Gerald Ford and over the other fence Henry Kissinger and Spiro Agnew." Jim is most anxious to replace the copy of his 1930 *Technique* that he lost and would be happy to hear from any of you who know of a copy he might buy. . . . Supplementing the item about **Hijo Marean** in last month's issue, he now reports that in his capacity as a Florida notary public he performed a marriage ceremony in 1981 and suggests that this may be a *first* for the Class of 1930. Do any of our three clergymen wish to contest Hijo's claim?

**Robert Lent** is still actively practicing architecture in Houston where he designs large residences for his clients. . . . Responses came in this month from our two Fosters, both of whom are now retired.

**Bob Foster** was a building contractor in Concord, N.H. and is still active as chairman of the Building Code Board of Appeals and in the Rotary Club. **Dick Foster** and his wife Josephine live in Chatham, Mass. where they both do volunteer work at a nearby medical center. Dick's hobby is repairing and refinishing antiques. . . . **Reg Tarr**'s retirement activities include service as a part-time assessor of the Town of Wenham where **Joe Harrington** is town moderator. Reg says Joe does an excellent job of presiding at the town meetings. . . . Thanks to **Don Stearns** we have at hand a clipping telling of the death of **Don Diefendorf** in Cazenovia, N.Y. on August 14, 1982. Don was associated throughout his career with the Diefendorf Gear Corp. of Syracuse, a frequent *Technology Review* advertizer, from which he retired as president and board chairman in 1979. He developed an early interest in the Boy Scouts as one of the first Eagle Scouts in Syracuse and in later years was an active member of the Onandaga Council. He was a past president and life member of the Technology Club of Syracuse, a past commodore and life member of the Willow Bank Yacht Club, and a charter member of the Cazenovia Area Ambulance Corps. His other memberships included the University Club of Syracuse, the American Gear Manufacturers Association, the Manufacturers Association of Central New York, and A.S.M.E. He was also a vestryman and senior warden of St. Peters Church in Cazenovia, as well as a past vestryman of St. Paul's Cathedral in Syracuse. Don is survived by his wife Ruth, who accompanied him to class reunions, by five sons, some of whom were associated with him in the Gear company, and by nine grandchildren.—**Gordon K. Lister**, Secretary, 294-B Heritage Village, Southbury, CT 06488

# 31

Unfortunately, at the time of writing these notes (mid-October) no further word had been received regarding the coming mini-reunion. If you have not yet received the August 11 letter about this reunion, please let us know.

A welcome letter from **Charles Terwilliger, Jr.**: "You're always looking for a bit of news. Well, I suppose this comes under the heading—*At Least I'm Happy That*—out of over 33,000 members, I was appointed last June a trustee of the Museum of the National Association of Watch and Clock Collectors. The museum is located at the headquarters of the association in Columbia, Pa. If anyone is traveling in the Lancaster area of Pennsylvania and is interested in clocks or watches, he would enjoy the museum in nearby Columbia."

Fortunately, no deaths of classmates have been reported since the last class notes were written.—**Edwin S. Worden**, Secretary, P.O. Box 1241, Mount Dora, FL 32757; **John R. Swanton**, Assistant Secretary, 27 George St., Newton, MA 02158; **Ben W. Steverman**, Assistant Secretary, 3 Pawtucket Rd., Plymouth, MA 02360

# 32

One of the duties of the class secretary is to be the bearer of sad tidings. Professor J. T. R. Nickerson died on August 16, 1982. He received his Ph.D. in 1938 and was a research chemist for several years with the Birdseye Co. He returned to M.I.T. and in due time became a full professor. He is survived by his wife Helen, a son, and two daughters. . . . **Thomas P. Dunleavey** died on August 4, 1982. He was born in Bridgeport, Conn., lived his whole life there, and he was the environmental city engineer. He served in the army during World War II as captain. He belonged to many professional, civil, and fraternal organizations. Survivors include his wife Anne, two sons, and five daughters. . . . **William B. Schneider, Jr.** passed away on April 16, 1982. His nephew Jonathan Bulkley wrote that William spent his whole life in Kansas City. He had polio when he was 2 years old and was in a wheel chair for over 70 years, but he never gave the impression of being limited. At M.I.T. he was on the editorial staff of *The Tech*, and a qualified ham radio operator. William was vice-president of Schneider Meat Co., and upon retirement he and his wife raised championship English bulldogs. He had an extraordinary sense of life and lived it to the fullest. . . . **Clarence M. Chase** died on June 21. He worked for Union Carbide as a long-range planner. He was active in civic affairs and church organizations. Survivors include his wife Alice, a son, and two grandchildren. . . . **L. Bowman Graton** died on September 18, 1982. He worked for 50 years as an architect, at first with partners and later in his own business. He designed many schools and small office buildings in Massachusetts and New Hampshire. He was an enthusiastic yachtsman and completed two Atlantic crossings in his own vessel. He also was a dedicated photographer and printed his own color pictures. Survivors are his daughter, a sister, and two grandsons.

In a different mood, I want to say that **Arthur Marshall** is one of our most active classmates. He has avidly followed aviation over 50 years. Recently he was on the inaugaural flight of the new Boeing 767. American Airlines gave him an award for his contributions to air transportation. He has made 25 trips to Israel. Just recently he returned from Lebanon where he witnessed many historic events and gained an understanding of Israel's position. Although he is a busy Springfield labor lawyer, he has made a deep impact in Springfield serving on at least two special commissions working for the Springfield Symphony Orchestra, YMCA, and the Boy Scouts. . . . Sam Burrows writes that his wife **Katherine Sarabia Burrows** invited him to her 50th, just as he had invited her to his 50th last year. Their big trip in 1982 was to Fiji, New Zealand, Australia, and Hawaii. He still likes to sail his *O'Day 30* out of Wellfleet and Lewis Bay.—**Melvin Castleman**, Secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

# 33 50th Reunion

The Reunion Gift Committee, chaired by **Dayt Clewell**, met in September to review our progress in raising $1.2 million for the Class of 1933 Professorship. At the meeting were **Cyrus Hapgood, Warren Henderson, Richard Morse, Frederick Murphy, Jr., George Stoll, James Turner, Stanley Walters**, and **Clarence Westaway**. Dayt reported that we must raise a minimum of $300,000 in gifts and pledges to reach our 50th Reunion goal. Members of the committee will be active in contacting classmates over the remaining months to ensure our success in this project. One attractive way to make a 50th Reunion gift is the MacLaurin Pooled Income Fund — you make a gift, receive a charitable deduction, and continue to receive income for the rest of your life and/or your spouse's life. For more information on our class gift or ways of giving, call Neil Didriksen at the Alumni Fund, (617) 253-8215.

Class President Murphy, along with George and Westy, reported on plans for the 50th Reunion. As I understand it, the reunion will not be at Chatham Bars Inn, because the property has been sold to a developer and is being rebuilt into condos. My hope is that we will wind up on campus. Like the 25th, we belong on campus, where we spent part of our boyhood.

**Vern Bowles** sends a short piece about life on Block Island. He and Dolores are in good health and neither is on any medication. They spend summers on the island, and hurry to Naples, Fla., come winter. Their home on Block Island apparently was part of their original purchase of about 5 acres of land. Since then, they have added a second house. They have also installed solar hot-water heaters in both houses, units of his own design—he is the owner of Solar Trap, a company he started earlier. For recreation, he and Dolores play golf twice a week and again Sundays, and they keep up a reasonable amount of social activities, mostly at their Club.

**Charlie Cashman** comes through with a short but welcome note. He is retired but still dabbles in law work. The reason he got into law was that, during World War II, he was assigned as defense counsel in a court-martial. Charlie, like me, is a bird hunter and a fly fisherman. He and Marie spent a week or so in the Gaspe in July and say that salmon were there, but were "smarter than we."

**Courtenay Marshall** lives in what we travelers used to call the preview of the hot place, Lockhart, Tex., where the glass stood at 100 degrees plus all summer long, so Court took off for the Canadian Rockies just to cool off. "We were in Banff only a few days when the Canadian Prime Minister showed up in his two Pullman cars for a few days of relaxation. A group of local citizens warmed up by throwing vegetables and eggs at his cars"—Court reminds us that the man is not popular in Western Canada. For the last three years, the Marshalls have gone to England on the American Horticultural Society tours, where they were able to visit English gardens and consort with the English gardeners. During their Canadian trip, they managed to see gardens in Vancouver, Victoria, and Seattle. The Marshalls have four children and nine grandchildren. One son is a lawyer in New York; a daughter was a professor in North Carolina, but decided to become a small-town lawyer in Texas; a second son is a teacher; and the third is a real estate agent in Washington, D.C. One granddaughter is in college, and the remainder go all the way down to kindergarten.

**Stan Walters** hopes that two letters from him in one year will not shock us greatly. Stan attended the Committee meeting I mentioned earlier, and says it sure was a great pleasure to see all those fine chaps and long-time friends. Stan informs us that he just heard from **John Sterner**, who says he has retired from the Cordis Corp. He will retain his Miami address, but will spend a long summer in Queche, Vt.

It occurs to me that many of our classmates

might some time want another classmate's address. Don't forget, I have all classmates' addresses that have been furnished to M.I.T. Alumni Records.—**Warren J. Henderson**, Secretary, 6015 South Verde Trail, St. Andrews Est., L-315, Boca Raton, FL 33433

# 34

There are some transient blips on the line still bouncing around from my trip abroad last spring. Things came in while I was away and some that had been destined for the December issue had to be carried over until now because of space problems. So if some things seem to be slow in appearing, it's not that they aren't appreciated.

The following news comes from Alumni Fund notes, with quite an extensive one from **M. E. "Rich" Richardson**. His has a neat, orderly tabulation that you would expect from an engineer. Paraphrased somewhat to fit our format, he says, "As of April 1982, Rich is still working as a full-time consultant for Coats and Clark, Inc. while his wife Eleanor is still in the Georgia Legislature and in June will receive an honorary doctor of law degree from Emory University, Atlanta. Since our 45th Reunion in 1979, they have made the following sailing and photographic ventures: Christmas 1979 (two weeks), chartered a 44-foot sloop in the Grenadines with Eleanor, daughter Meryl, and husband and two grandsons; Thanksgiving 1980 (two weeks), Bermuda with Eleanor; Easter 1981 (two weeks), with Eleanor, Lake Tahoe, Yosemite, Sequoia, sailed into the Pacific from San Diego, then on to Tuscon, Ariz.; Thanksgiving 1981, Hilton Head, S.C. . . ." Rich didn't specify but presumably he let Eleanor go to Hilton Head with him!

From the distaff side (is that now a sexist word?) of our class **Evelyn Killam Hoar** writes "Retired from work as a designer after 25 years with Engineers, Inc. in Newark, N.J. It will be a pleasure to stay home for a while. Recently enjoyed caring for my first grandchild while his mother, who does research at the University of Miami School of Medicine attended professional meetings in Boston." . . . I also had one from **Bill Ball**, who practically lives next door when you look at the whole U.S. He had some kind words for my efforts, but I'll let him say one thing for me—"I think he'd welcome at least a brief note from each of us, if only once a year." To which—Amen! . . . Another note that got buried in my papers was one that **Ted Rimbach** had sent directly to me and it came while I was away. Since it had news of a personal loss of Ted's, I'm very sorry to be so late in getting to it. He wrote that in August 1981 his wife Sylvia died very suddenly. Naturally, the past months have been difficult for him but his children and sisters have helped greatly. Over the years Ted has included me on his Christmas mailing list, and the family letter he and Sylvia sent out testified as to how closely knit the family was. So it is with really personal feelings that I extend our sympathy to him. He closed his note with the comment that he is still working hard and that it is perhaps his biggest support that it continues to be interesting.

Ted also sent an extensive clipping from one of the St. Louis papers on the retirement, in May, of **Harold E. Thayer** as board chairman of Mallinckrodt, Inc. Harold had gone to Mallinckrodt in St. Louis in 1939 as an engineer in sales research and product development and in 1950 became the youngest vice-president in the company's history. He moved to the presidency in 1960 and to the position of chairman and chief executive officer in 1965. The article was full of tributes to Harold's business and managerial ability from a wide spectrum of St. Louis businessmen, but these qualities are most vividly shown by sales that rose from $32 million in 1961 to $494,353,000 in 1981, while earnings in this period climbed from $821,000 to $39,701,000. We have several times noted the honors that came to him for his professional and civic activities. They covered very diverse fields, including work with the Corporate Development Committee of M.I.T. This is a very brief review of Harold's accomplishments, but one of the most pleasant features of it is that I can write while the subject is still here to read it.

Among more recent items is a note from **Ed Asch** who writes, "Always glad to hear the positive things the fellows are doing. Had a phone call from **Carl Wilson**, but I must admit that I was thrown for a few moments by his self introduction: 'This is the Mug.' Coming from 1,000 miles away this didn't add up at first. . . . Life continues placidly in Houston. Summer is winding down. Football season is under way (That's what he thought in September!) and I'm still keeping busy. Leaving for a vacation in Paris and the Loire Valley in a couple of weeks." . . . A June newspaper clipping brings information about **John Newell's** activities with the Maine Nuclear Referendum Committee. This group had led the petition drive for the referendum ballot to close the Maine Yankee nuclear plant in five years. John had been trying to get Maine Yankee president Elwin Thurlow or another plant spokesman to debate the proposed shut-down on statewide television. No further word about the debate. Look back at the election returns as to what happened.

I have one more loss to report—the death on July 3 of **Frederick Pattee**. He lived in Monmouth, Ill. and while he became ill there in May, he died in the Mayo Clinic in Minnesota. From his obituary it seems he made somewhat unusual use of his chemical engineering training. He had joined his father's feeding and farming operation and was an authority on cattle and cattle feeding. He had also been active in the banking business in and around Monmouth. Mr. Pattee had served as a lieutenant in the Navy in World War II and had a long-time interest in boy scouting and a number of local civic activities. The clipping was accompanied by a note from **Sam Groves** who apparently knew the Pattees personally. For the class I would offer our condolences to Mrs. Pattee who, from Sam's note fortunately seems to have things well under control.

**Lester Tarnopol** writes, "The M.I.T. Club of Northern California is preparing two seminars for spring 1983. The first will be on 'The Educational System in Japan and its Relation to Productivity.' The second will be on 'Japanese Production and Management.' The dates have not as yet been set. My wife (professor Muriel Tarnopol) and I will be among the speakers. . . . I have just completed a paper (co-authored) on 'Arithmetic Achievement in Three Japanese Schools: Lower, Middle, and Upper Socioeconomic,' which will be published by *Focus on Learning Problems in Mathematics*. The paper is based on testing 2nd and 5th grade children in Hiroshima and Tokyo. At present, I am converting all of the Wechsler Intelligence scales that have been normed in foreign countries to U.S. norms (IQs) for comparison. Previously I published the Chinese (Republic of China) and Japanese comparative performance IQs and now I am working on Germany, Spain, France, Denmark, and Israel. Those are the only countries that have normed Wechsler IQ scales on their populations. My wife and I have been invited to lecture on our research and to continue it at the University of Venezuela in January and February, 1983."

A few items of personal contact: Just before Labor Day we went down to East Marion, Long Island to visit Mora and **Eric Isbister**. Eric was on vacation from Charlottesville, Va. where, back from Ottawa, he is still working with Sperry Marine as a consultant. **Adrian Ross** and Ruth were arriving shortly and I found out that Adrian had joined my club—in the spring he had undergone coronary bypass surgery that was very successful. In fact he and Ruth were planning an extensive cruise.

Early in October we went to New Hampshire to see the foliage. On the way back we stopped for a night in Eliot, Maine to see **Ted Taylor** and Winnie. They had had a close call in an August storm—a 200-year-old elm (four feet in diameter!) had come down right alongside their house. The only damage was a sundeck that was taken out by one of the big branches. Winnie is a vigorous gardener and we came home laden with tomatoes, grapes, and Chinese cabbage. They will be off to Mexico for the winter towards the end of December, this year with some misgivings as to just how they will stand with the pesos they have there.—**Robert M. Franklin**, Secretary, P.O. Box 1147 (620 Satucket Rd.), Brewster, MA 02631; **George G. Bull**, Assistant Secretary, 4601 N. Park Ave., Apt. 711, Chevy Chase, MD 20015

# 35

**Randy Antonsen** and **Ned Collins** hosted our mini-reunion for the Boston area on September 11 at Endicott House in Dedham. Twenty-five classmates, wives, and guests enjoyed socializing over cocktails, a sit-down lunch, and listening to our M.I.T. guests tell us about what was going on at the Institute. Attendees, in addition to the hosts, included: Kay and **Chet Bond, Arthur Cohen,** Sarah and **Nix Dangel,** Janice and **Leo Dee, Ellis Flink,** Agnes ( Mrs. **George**) **Forsburg** (George was ill and unable to attend), Jane and **Pete Grant, Walter Green,** Ida and **Macklen Kleiman, Allan Mowatt,** Rhoda and **Bernie Nelson, Leo Beckwith,** and **Dudley Williams**. Our M.I.T. guests included: Bill Dickson, senior vice-president: Paul and Maura Johnson, regional director, Alumni Association; and Warren Seamans, director, M.I.T. Museum and Historical Collections. Joe Martori, associate secretary, Alumni Association, was unable to attend as his wife was in the hospital.

As you know, I am recruiting for our 50th Reunion crew, and **Nix Dangel** has agreed to be our coxswain. Nix is doing consulting after 37 years with the Kendall Co. . . . **Arthur Cohen** is still an active architect and member of the Boston Stein Club. . . . **Mack Kleiman** is still going strong after 32 years with his Lynn Screw Co. . . . **Walter Green** was a research chemist with Hunt Chemical for 23 years. . . . **Leo Dee** said he would row on our 50th crew. . . . I have already received okays from **Art Haskins, Bob Olsen, Don Wood,** and would like to hear from anyone else who would like to participate in a very light and short row.

"**Jim Libby**'s complaint in your '35 column precipitated my taking this machine in hands," begins **Rollin Morse**'s letter. He continues, "My address is 30 South Second St., Columbia, PA 17512, but I'm retired from both professional engineering and my patent practice. After three years of retirement from duPont, the urge to have less acres of lawn led me to persuade my wife Virginia that we should sell the farm—106 acres—for something smaller. Our joint interest in historic places and antiques led us here to Columbia, where we acquired the third oldest place (1795) next to the oldest (the Wright Mansion, 1738, a museum). Columbia, depressed for the last 50 years because it was bypassed by rail and road and because it lost most of its industry and its downtown shops, has a marvelously preserved architecture, both residential and business. But it is in great need of revitalization. (Haven't you heard that before?) Hardly had we settled here before we joined the local chamber, reactivated a somnolent Columbia Area Improvement, Inc. (CAI), bought a store building to prevent it being demolished for parking lots, opened an antique shop as a downtown vitality step, got elected to Borough Council, and joined Rotary. I'm executive secretary of CAI. We raised money, hired a consultant, prepared a revitalization plan, and are starting to put it into effect. We bought a former church and are starting on the conversion to a museum of Columbia history, as a tourist attraction. And just two weeks ago, after four years of fighting for funds and one year of intensive work, I went to Harrisburg with our application to register a district (including nearly 1,000 structures) as a national register historic district. Right now, I'm tired, and thinking of retiring from my unpaid job. But with the registra-

tion application filed, my blood pressure is coming back down, and I have put away the sleeping pills. The museum of history, in sight one block away, is looking better every day, and it looks like we'll be able to hire a young revitalization manager. So most things are for the better.

"Our two girls are in the Boston area. One is corporate and executive secretary for a young biogenetics firm, and her husband is editor of *Training News*. The other, now that her two boys are almost adult, has gotten her degree, is a practicing physical therapist working toward her M.S., and is a director of the Head Injury Foundation." Thank you, Rollin, for your most interesting letter. That is one of the most energetic five-year retirement periods I have ever heard of! The brochure you sent me on Columbia is excellent.

Rhoda and **Bernie Nelson** just returned from a 15-day trip (their first) to France including visits to Paris, Marseille, Cannes, Nice, Monte Carlo, Italian Riviera, Mt. Blanc, and Luxembourg. . . . **Bill Cross** reports having had ham radio schedules with **Jim Parker** while he was on Bakers Island and with **Les Fitzgibbon** from Barbados last February. . . . **Walter Stockmayer** hit the University of Michigan News by being one of those invited to speak at the sixth annual symposium on current contributions in polymer science held in late October. . . . The 22nd year of our Class Golf is winding down with **Chet Bond** and **Hal Bemis** flight winners and **Bill Cross** and **Dick Bailey** consolation winners, meeting in the semi-finals.

I am sorry to have to report the death of **Vincent Sorrentino** in Concord, Mass. on October 3. I extend the sympathy of our class to Beatrice, his widow. Vincent was purchasing manager of Raytheon's Missile Systems Division for 25 years. We were supervisor buyers together in Raytheon's Equipment Division, as it was then called, from 1949 to 1951, when I left to start my first company. . . . By now you are recovering from the holidays and should find it a good time to write your 5-, 10-, 20-year letter to your class secretary. I'm still the perennial optimist!—**Allan Q. Mowatt**, Secretary, P.O. Box 92, Newton, MA 02195

# 36

Greetings! This time there are no obituaries or unpleasant news items to report. . . . I will continue with information gleaned from our 45th Reunion questionnaires. **Frank Parker** has been active in town affairs in Wellesley Hills since his retirement some years ago from Charles T. Main, Inc. He writes, "I became active as a trustee, building committee chairman, etc. of the New England Medical Center Hospital, an urban teaching hospital (Tufts) of 450 beds and 3,000 employees. Eventually, I served two separate six-month stints as acting chief executive officer, a position now held on a permanent basis by a much younger and smarter M.I.T. graduate." Frank's four children have produced 14 grandchildren. . . . **E. MacDonald (Mac) Nyhen** joined the U.S. Department of Commerce in 1954 where he has held a number of positions concerned with domestic business and international trade of the U.S. electronics industry. He has a daughter and a son and has been a widower for many years. . . . **Robert Newman** retired in 1975 as manager of Corporate Planning Services for General Electric and has actively pursued his interest in archaeology. He has participated in several digs including a Cornell University expedition into the Chilean Andes in 1976, where they were "trying to locate the southernmost outpost of the Inca empire, and to determine the degree of civilization there." Near the Argentine border they found a fortification that existed from 1400 to 1500 A.D. In pursuit of his interest he has visited virtually every major archaeological site outside China and perhaps by now he's been there, too.

**Thomas Nelligan** sold Pokorney Manufacturing Co. in 1978 and remained for a year and a-half to run it for the new owners. He retired completely in January 1980, and moved from Illinois to Hilton Head where he enjoys playing golf. By now the Nelligans must be in the house they were building "between two golf courses." They have two daughters—both career girls, one in Boston and one in Baltimore. . . . **Albert Musschoot** formed General Kinematics Corp. in 1960. It has developed into an international corporation headquartered in Barrington, Ill., with a unique position as an innovator of heavy-duty vibrating equipment—feeders, conveyors, fluid bed coolers, and vibrating process equipment. . . . **Richard Murrow** spent 33 years in aerospace and related businesses and is now retired as military research analyst with the Rand Corp. He continues to consult for Rand, R & D Associates, Northrop Corp, and Technology Associates of Southern California, Inc. He is always interested in applying modern technology to solve persisting problems in many industrial fields. He is also interested in ornamental horticulture including orchids and rare palms, music (piano), and the theatre. He has worked diligently for the Westwood Homeowners Association to try to preserve the quality of the neighborhood against noise, traffic, and commercial encroachment. Since my sister lives just around the corner, I am well aware that this last is a problem indeed, close as it is the the UCLA Campus.

**Bill Mullen** is self employed in Glendale, Calif., as a construction cost consultant. He and Mary have two children and two grandchildren. He has time for and enjoys golf, and he supports all worthy conservative causes! . . . **C. R. (Bud) Milone** has little to say except that he is retired from the vice-presidency of the Goodyear Tire and Rubber Co. and Goodyear Atomic Corp., has two children and four grandchildren, and has served on boards such as the United Way and YMCA. I'm wondering whether he still can maneuver on roller skates. . . . **Russ Miller** retired as a marine insurance underwriter and moved to Fryeburg, Maine, where he enjoys life in winter—a battle against the weather and sub-zero temperatures (much to the disgust of his Florida friends). He enjoys jogging and belongs to a contra dance group specializing in dances of the 18th and 19th centuries.

**Harry Essley** wanted to encourage the reproduction of our reunion questionnaires and made a contribution toward that end. I now have easy access to a very good copier and expect to get to work on it shortly. It will require some preparatory work, because many of the photographs will have to be trimmed.—**Alice H. Kimball**, Secretary, P.O. Box 31, West Hartland, CT 06091

# 37

**Alfred E. Busch**, who was a director of K & E before its acquisition by Kratos, was also elected a director of Kratos, a designer, maker, and marketer of products for use in advanced technology and engineering. . . . We are delighted to report the marriage of **John H. Fellouris** on September 4, 1982 to Peggy Wentworth Derby. We wish them both years of health and happiness. . . . **Thomas F. Hennessy** writes that in retirement he is advising Condo Community on architecture and maintenance. He golfs, sketches, and plays tennis. He would like to hear from classmates on their activities and whereabouts.

**Sidney Mank** (Route 1, Box 895, Washington, VA 22747) was unable to attend our 45th Reunion because of illness in the family. "With parents, 92, 89, and 84 years of age, it is difficult to adhere to plans." He sends a short summary of his activities after leaving M.I.T. "After graduation, employed as superintendent of construction for Aetna Fireproofing Co. of New York City, steel frame buildings and concrete construction, 1937-1941. U.S. Navy, Civil Engineer Corp., December 1941-1946. Three years overseas with the Sea Bees, lieutenant commander. Due to malaria, had to go to Florida, Road Construction Corp., General Superintendent of Construction 1946-1949. Built first blockhouse and landing pads at Cape Kennedy, Fla. Started my own construction company with a partner, Bernard Janis, a West Point graduate. Housing projects and commercial construction in south Florida, 1950-1960. Disolved partnership (very friendly) and started my own MANK Construction Co. Built buildings and either kept them for income or sold them, 1960-1976. Retired in 1976 to a Virginia farm (gentleman's) of 28 acres and love it. Personal history: Married (June 14, 1941) Dorothy H. Abbott, and we are now happily married 41 years. March 24, 1943, Andrew Donald was born. He is now a graduate architect with a master's degree in planning; spent 12 years with EPA as deputy assistant director, but couldn't stand the new Reagan policy; started his own consulting firm. Andy's wife Sally is a government planner in Washington D.C.

"Dot and I love working around our farm, gardening both flowers and vegetables. We also work on many charities—Lions of Rappahannock, Cancer Society, Volunteer Fire Dept., and the Garden Club. We love our life but miss our Miami friends and the bagels and lox. Right now is a difficult time because of our parents' ill health. **Harry Corman** visited us with his new wife. He is still working, flies his own plane, and keeps in touch. Saw **Link Herzeca** and **Al Wynot** on my last trip to Florida. They are both retired. Al is not well and his wife Dot was ill when I visited them—no children. Link retired from New York City government and lives in south Miami—2 children."

**Douglas Carter** writes, "My wife Erma and I retired at 620 Wallis Rd., Rye, N.H., where we built the house in which we now live. We moved in in 1951. At that time I was working as a naval architect on submarine design at the Portsmouth Naval Shipyard and continued to work there until my retirement on September 1, 1978. We have three sons. Stephen, the oldest, a Brown University engineering graduate, is presently a dean at Phillips Academy in Andover, Mass. He also teaches mathematics and supervises football and lacrosse. He is married and has two children. John, the second son, lives in Canaan, N.H. and is the music supervisor for the public schools in the city of Hanover. He is a graduate of Oberlin, is married, and has four children. The last son, William, is located in Houston, Tex. and has his own contracting business, constructing houses. He has only been married a year. Our travels have been somewhat limited to a number of trips to Bermuda and numerous trips to visit the grandchildren. We are also back and forth to Salem, N.Y., where I own a 100-acre farm. We have been trying to restore the farmhouse which is quite old. It is progressing slowly but we hope to see it finished in the near future. This restoration project is my hobby and it keeps me busy."

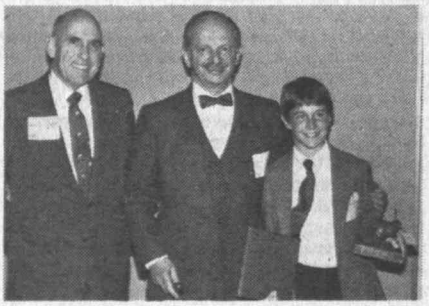
**Henry H. Guerke** (910 Raubsville Rd., Easton, PA 18042) retired from Bethlehem Steel Corp, Bethlehem, Pa. in June 1982. Henry completed more than 44 years of company service. Following graduation from M.I.T., he advanced through several metallurgical positions. In 1945 he was transferred to the sales department and served in Chicago and Indianapolis. In 1979 he was promoted to product supervisor, drop forgings. He and his wife Lois have five children and 11 grandchildren. They plan to remain in the Lehigh Valley.

We are saddened to report the death of **George M. Levy** on September 4, 1982. He is survived by his wife Barbara, 210 Nahanton St., Newton, Mass., by daughters Jane Reed of San Francisco, Calif. and Nancy Konesky of Needham, Mass., and by two grandchildren. Remembrances may be made to the Women's Aid for Heart Research, in care of **Phyllis Baker**, 434 Clinton Rd., Brookline, MA 02146.—**Lester M. Klashman**, Assistant Secretary, 198 Maple St., Malden, MA 02148; **Robert H. Thorson**, Secretary, 506 Riverside Ave., Medford, MA 02155

# 38 45th Reunion

My neighbor (and our class prexy) **Dave Wadleigh** was recently elected vice-president and

*The 1982 Bronze Beaver to Joseph G. Gavin, Jr., '41 (left), from Denman K. McNear, '48, president of the Alumni Association. "Quietly unassuming, Joe's thoughtful leadership . . . and dedicated support of the Institute for nearly a half century . . . (and especially) his concern with the quality of an M.I.T. education and the importance of maintaining the M.I.T. connection after graduation . . . have been an inspiration to younger alumni and to staff." (Photo: Philip L. Molten, '55)*



*The 1982 Bronze Beaver to Frank S. Wyle, '41 (middle—with his grandson, Noah Wyle) from Denman K. McNear, '48, president of the Alumni Association. "In recognition of total commitment in support of . . . an extraordinary number of M.I.T. and Alumni Association positions since his graduation in 1941." (Photo: Philip L. Molten, '55)*

program chairman of the M.I.T. Club of Cape Cod, where I usually see Roberta and **Horace Homer**. . . . **Don Severance**, in his dual role as chairman of our 45th Reunion to be held in June at the Wianno Club on Cape Cod, and as director of the Leadership Gifts program at M.I.T., reports that he saw **Dempster Christenson** at the Alumni Officers' Conference in San Francisco. Dempster still lives in Sioux Falls, but, more importantly, was awarded one of the George B. Morgan citations at the conference.

While in San Francisco, Don had cocktails with **Pete DeFlorez** at his apartment on Nob Hill. Don also saw **Don Barnaby**, who recently retired so that he could have more time for sailing. . . . Molly and **T. Y. Shen** from Taiwan recently flew to Boston for a vacation.. . . **Demetrius Jelatis** is still active in Red Wing, Minnesota, although the company was sold to Sargent Industries.

Again, a reminder: June 9, 1983 is the start of our 45th Reunion. You'll get an announcement soon.—**Armand L. Bruneau, Jr.**, Secretary, 663 Riverview Dr., Chatham, MA 02633

# 39

**Richmond Kaufman** earned additional recognition at Fairchild Industries with his appointment to vice-president of the parent company. . . . **Hewitt Phillips** was honored by the Experimental Aircraft Association with a plaque: "Distinguished NASA Aeronautical Researcher." When Hewitt and Viola travel to visit their daughter who lives 40 miles north of our home, possibly Hewitt can do his "thing" researching hang gliders which are flown daily off a 300-foot cliff at the edge of the Pacific Ocean. Since my "thing" has mostly to do with manure, on an international basis, I won't be able to help Hew on that technical glider research. So, I'll take a few notes and let you all know how it comes out. . . . Aletta and **Bob Touzalin** have carried their golf clubs to Scotland and the Inner Hebrides, where Bob shoots his age and Aletta buys woolens and yarns. But, Aletta, what will you do with them after you come back to your tropical home at Naples, Fla?

Elaine and **Sam Sensiper** continue occupying the same dwelling in Los Angeles these last 26 years, as Sam now consults for microwave majors and Elaine teaches. A coincidence happened recently when their son graduated from the University of California at San Diego and they attended the campus ceremonies. It turned out the son of **Paul Sokoloff** graduated the same place, same day; however, in the crowd of 50,000 or so, the Sensiper parents did not see the Sokoloff parents. . . . **Bill Wingard** and his son are setting new records for "busy-ness" in their Baltimore machine shop business. They don't seem to know there is a deep national recession in their line of work. In addition to his other many achievements, Bill personally prepares for his overnight guests a very tasty breakfast including "just-so" scrambled eggs garnished with chives that he personally grows with TLC. (For the uninitiated, "TLC" stands for tender loving care, not manure.)

Adie and **Bill Pulver** stay trim golfing near Lakeville, Conn. The Pulvers also enjoy surf-sailing in the summer and ice-boating in the winter.—**Hal Seykota**, Secretary, 1603 Calle de Primra, La Jolla, CA 92037

# 40

When you read this, 1982 will be history. A happy and prosperous 1983 to all!

Last summer found Lois and **Doug Eckhardt** visiting relatives in Newton, Mass. We were delighted to have them visit us for a swim and a game of bridge. Doug has been retired and is living in Ft. Myers, Fla. for approximately four years. His ham radio and computer analysis of financial investments have kept him occupied. . . . Your secretary spent the weekend, October 2-3, at the Centennial Celebration, Course VI, at M.I.T. Although this event was very well attended, there were not many from the Class of '40. . . . **Bob Gould** and his wife Marian drove down from Mirror Lake, N.H., where they are in the process of completing their retirement house. Bob retired from Sperry Rand Corp., Great Neck, N.Y., in 1980. Skiing still keeps him occupied in the cold winter months.

**Bart Weller** attended the Centennial Celebration. He recently relinquished the position of president of Vitramon, Inc., Bridgeport, Conn., an organization which he founded in 1948. However, he remains as chairman of the board and CEO. Bart sent me a booklet covering the history and achievements of the company, which celebrated its 30th anniversary in 1978. A truly great free enterprise accomplishment, from basement and garage to an internationally-known multi-million dollar corporation, which has brought technology and influence to the many corners of the world. It all started when he was employed by E.I. duPont during World War II and was asked to find a substitute for precious mica, which was used in electrical capacitors. What he uncovered was porcelain, a material offering the characteristics desired. Since mica was readily available again after the war, interest in porcelain capacitors waned. At this point Bart decided to start his own operation. In 1953 *Fortune* magazine chose him to be the subject of a book on business success, and in 1977 he was one of the first to be elected to the Bridgeport area Free Enterprise Hall of Fame. Today Vitramon components are used throughout the electronics industry.

A recent news clipping indicates that **W. H. Krome George**, chairman and CEO of Aluminum Co. of America, has been made a director of the Todd Shipyards Corp., New York, N.Y. . . . **W. Kenneth Davis**, deputy secretary, Department of Energy, received the 1982 National Engineering Award at the Engineering Societies' Annual Awards Banquet on September 15 in Crystal City, Va. He has published over two hundred articles and papers and is a former vice-president and manager of research and development of nuclear projects for Bechtel Corp. Kenneth is the former vice-president of the National Academy of Engineering, past president of the American Institute of Chemical Engineers, and a member of the U. S. National Committee, World Energy Conference.—**Donald R. Erb**, Secretary, 10 Sherbrooke Dr., Dover, MA 02030, (617) 785-0540

# 42

A very terse report from **Russ Crane** quoted in its entirety: "Retired November 1, 1981, after 32 years with Combustion Engineering." That certainly covers the item, Russ, but how about sending more news about what you are doing in Barnstable? . . . **Steve Stephanou** has just published his second book entitled *Systems Approach to Societal Problems*. The publisher is Daniel Spencer Publishing Co. in Malibu, Calif. It certainly does have an impressive title!

**Al Hayes** writes that he and Molly had a very enjoyable time at our 40th Reunion and that they plan to fly their airplane back to Cambridge again for our 45th. It is a fairly long trip from California to Cambridge, but apparently the Hayes' do enjoy it.

A multi-column multi-page article from the Keene, N.H. newspaper gives profiles of eight Republicans who plan to run for governor of the state. Among them is **William Byron** who graduated with our class from Course VII. Bill told the newspaper that he plans to spend a maximum of $500 on his campaign which includes the $100 filing fee. If he makes it in these days of multi-million dollar multi-media campaigns, it will certainly break new ground in the political scene. By the time you read this, quite obviously, the election will be over.

Still on the subject of New Hampshire politics, we have an unusual newsy and interesting letter from **Bob ("Hawk") Shaw**. He reports that the M.I.T. Club of New Hampshire is practically organized, but otherwise things are in total chaos in his own town of New Ipswich. Hawk says they are without legal public health, and medical examiner services. If memory serves, the medical examiner is one Robert Shaw, M.D. Do not know what the details are. In any case, Hawk is still busy with his medical practice, running his farm, and generally commenting on the social and political vagaries of his neighbors.

One obit this month—**Frederich Olsen** passed away. Fred had retired from Olin Corp. some time ago. He graduated with our class from Course X in 1942 and got his master's in 1943. Fred was later a Sloan Foundation Fellowship student and even later concentrated in medieval studies at Columbia. This turned out to be his hobby. We extend sincerest condolences to Marjorie and the family.

Since you will be reading this in January, very best wishes for a healthy, happy and prosperous 1983.—**Ken Rosett**, Secretary, 191 Albemarle Rd., White Plains, NY 10605

# 43 40th Reunion

A news release from Hercules, Inc. announces the appointment of **Robert I. Mason** (Course V) as marketing director of industrial programs, Marketing Division. Robert has been with Hercules since his graduation from M.I.T. and has worked his way up in research, sales, and marketing. . . . **Al Babcock**(Course X) reported by telephone from New Canaan, Conn. A widower in 1979, he married his present wife Barbara, and they have been watching the progress of a daughter at Wellesley and a son at Lehigh. Al is vice-president of engineering and technical service for the International Division of Borden, Inc. He is involved in plant construction and technical service overseas for food, chemical, and dairy products.

Another telephone conversation yielded information from **Herb Twaddle** (Course X). Herb retired from the navy in 1980 as a captain, U.S.N.R., and wants to thank all his classmates for contributing to his pension. He now lives in Arlington Hts., Ill., occupying some of his time helping Amoco Chemical comply with the Toxic Substances Control Act. Herb is the proud father of three children who have left scholarly tracks at the University of Chicago and Indiana Medical School. He also has a wife who takes him square dancing occasionally. For relaxation during his recent Washington confrontations with the EPA, Herb searches the Library of Congress for Twaddle roots.

**Dick Feingold** (bless him) has sent a bulletin from the M.I.T. Club of Southern California announcing that **Dick Adler** was the featured speaker at the September meeting. Professor Adler is the Associate Head of M.I.T.'s Department of Electrical Engineering and Computer Science. His talk, "The Electronic Revolution," was a synopsis of the presentation he made the following weekend at the San Francisco Alumni Officers' Conference.

My wife and I recently returned from a vacation in Quebec, where auto parts are *auto pieces*, used furniture is *usameubles*, and 82 cents equals a dollar. If you don't send in more news, I'll have to start showing my slides.. . . Be reminded again about the 40th Reunion and Reunion Gift.—**Bob Rorschach**, Secretary, 2544 S. Norfolk, Tulsa, OK 74114

# 44

Much has been written as to how the weather affects our lives and our attitudes towards life. So, no matter where you are residing this month, let's hope that your troubles are few and that your blessings are many.

**Carl Lindemann, Jr.** has been invited to join the Institute Visiting Committee on Athletics. . . . **Donald A. Arsem**, chairman and CEO, Wurlitzer Co., has been named a faculty member of the State University of New York at Buffalo.

On September 30 **C. William Ritterhoff** retired from the Bethlehem Steel Corp. after 32 years of dedicated service. Bill started at the Sparrows Point, Md. plant in 1948 as an assistant engineer in the mechanical department and worked his way along to become assistant chief engineer of the plant engineering department in 1960. In 1963 he was named assistant chief engineer for the Burns Harbor, Ind. project. Later he became assistant general manager of the new plant and in 1967 the general manager. In 1970 he was transferred to the home office where he was elected vice-president, manufactured products in steel operations; an executive vice-president in 1974; vice-chairman in 1977; and his last post, executive vice-president in charge of steel operations. Bill and his wife Cleo plan to remain in the Lehigh Valley in retirement.

**Andrew F. Corry**, senior vice-president, Boston Edison Co., will receive the 1983 William M. Habirshaw Award for "outstanding technical accomplishments in designing and operating underground cable systems and for leadership in organizing and directing high-voltage underground electric power transmission research and development" at the winter meeting of the Power Engineering Society, IEEE, to be held in New York, January 30 to February 4, 1983. Needless to say, Andy is most proud of this recognition of his achievements, and his friends join him.

On July 1 your secretary stopped taking new clients in her genealogy business in order to devote the next two years to completing the documentation of accepted lineage papers, cleaning out her house preparatory to its sale, and making investments for retirement income. There will be some slippage on the original time table as I broke my hip on September 17 and have been necessarily slowed down, almost to a halt, for some months to come. Fortunately I have retained my positive attitude and have hopes that I can soon return to divesting my home of an accumulated collection more than 30 years in the making.

Those friends and classmates who would like to join the reunion committee for a May weekend at Martha's Vineyard are asked to consult this column in the next (February/March) issue for details as to dates and location.—**Melissa Teixeira**, Secretary, 92 Webster Pk., West Newton, MA 02165

# 46

A letter I received in September from **Russ Dostal** told me that he had had angina symptoms back in November 1981. A cardiologist asked him to lose 22 pounds before they could/would do a heart cath. He did this by the end of April 1982 and proceeded to have a heart attack right on the hospital table during the exam. He spent the next six weeks "being very careful" before entering the Cleveland Clinic, rightfully reknowned for bypass surgery. They gave him a triple bypass on July 6, and it went well. He was released a week later and rested at home until September before resuming half-time work. With care, he expects to be pretty much back to normal by the time you read this. You might send him best wishes at 18837 Palm Cir., Cleveland, OH 44126.

Got a note relayed from A.D. Little with an extract from a talk given by vice-president **Ted Heuchling** on the struggles of the U.S. freight transportation industry with the impact of deregulation. To paraphrase (badly, I'm afraid) Ted, who is Little's transportation specialist says, "It's a whole nuther ball game," as they say, in which the railroads and truckers have to shuck off old habits and priorities in order to remain in business.

Judging from a recent change-of-address card from **Hillman Dickinson**, he has retired from the army as a lt. general and is now in private industry in Washington, D.C. His present address is 4331 Garfield St. N.W., Washington, DC 20007, in case you'd like to write or drop in on him.

Leafing through the Class Roster (again), I wonder if: **John Maynard** is still a staff scientist with Honeywell (Minnesota) and living in Palm Beach Gardens, Fla.? Sounds like a helluva commute, John, How cum? . . . **Bill McGrath** is still with Factory Insurance Association in Boston and living in Lexington? . . . **Stan Meduski** is still president of his Shopping Center, Inc. in Warwick, N.Y., and living there as well (not in the shopping center, of course)? Stan, I still remember your jock-free sprint in one of our V-12 track meets. Like to died laughing. . . . **Dave Moyer** is still director of Ford's Systems Research Lab in Dearborn and living in Harbor Springs, Mich.?

Anyone wanting to get in touch with the above gentlemen, drop me a line. . . . Peace.—**Jim Ray**, Secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

# 47

Two new books by classmates deserve our attention: **Norm Holland**, the James H. McNulty Professor of English at the Center for the Psychological Study of the Arts at the State University of New York, Buffalo, has authored *Laughing–A Psychology of Humor*, which is at least his seventh book dealing with literature and literary response. It is published by Cornell University Press. The review cites Norm as a renowned psychoanalytic critic and calls the book "witty, engaging, trenchant," saying further that it will attract anyone who wants to have reasons for laughing. Norm, with wife Jane, made a lecture tour of Europe last spring, completing his year's sabbatical lecturing at the Hungarian Academy of Sciences, the University of Rome, and the Sigmund Freud-Gesellschaft in Vienna. . . . **Ginny Grammer** (c'est moi) wrote the other tome, which is too new at this time (October) to have been reviewed, so I shall praise it myself. *The Terrapin Logo Language for the Apple II* tutorial manual, sent to all who buy or have bought Terrapin Logo, and of which all but one chapter (the also superior Words and Lists) was written by moi, introduces the beginner to the delights and challenges of Logo, the computer language cum learning environment which was developed at M.I.T. by Seymour Papert. Logo was described in detail in the August 1982 issue of *Byte* magazine. This semester I am a professor in the Computer Science Department at Wentworth Institute, Boston.

*The 1982 Bronze Beaver to Richard A. Knight, '47 (left), from Denman K. McNear, '48 (right), president of the Alumni Association. "Dick Knight's creativity and energetic force have won him the respect and affection of alumni around the world . . . an open, friendly, welcoming presence for all in the Alumni Association."*

**Gerhard Reethof**, professor of mechanical engineering and director of the Noise Control Laboratory at Penn State, has been named a fellow of the American Society of Mechanical Engineers in recognition of his significant contributions to the field of engineering. After graduation, Gerhard worked for a year at Sperry, then returned to M.I.T. in research, finally becoming an assistant professor of mechanical engineering. In 1955 he left to become chief of research at Vickers Inc., directing activity in fluid power controls. In 1958 he joined the Flight Propulsion Division of General Electric, where he worked on various aspects of performance and reliability of jet engines, and noise control technology. He was named Alcoa Professor of Mechanical Engineering at Pennsylvania State University in 1967, where he developed the Noise Control Laboratory, which he now directs. He was Fullbright Professor at the Finland Institute of Technology from 1953-54, and in 1982 received the Outstanding Research Award for the College of Engineering, Penn State University.

**John Yocum** has been elected to the Connecticut Academy of Science and Engineering, a group of 200 distinguished scientists and engineers who work or live in Connecticut. John is vice-president and chief consulting engineer at TRC Environmental Consultants, Inc. of East Hartford, Conn. He is a registered professional

engineer in several states and a diplomate of the American Academy of Environmental Engineers. He is nationally known as an expert in the field of air pollution and has published extensively. He has done pioneering work on the effects of air pollutants on materials and on indoor air quality. John is a member of the board of directors of the national Air Pollution Control Association, at whose request he has published a critical review of the state of knowledge on indoor-outdoor air quality relationships.

**Melvin Becker** has retired as vice-president-operations, Bethlehem International Engineering Corp. (BIEC), a wholly owned subsidiary of Bethlehem Steel Corp., a position he has held since 1979. Prior to that he was assistant general manager of Bethlehem Steel's Johnstown, Pa., plant. Melvin has been with Bethlehem Steel Corp. since graduation, when he joined their management training program. He is a registered professional engineer in Maryland and Pennsylvania. For the time being, Melvin and Inge will stay in Bethlehem. . . . **Mario DiFederico**, currently a business consultant for Firestone Tire and Rubber Co., was elected a director of Fisher Foods, Inc., Bedford Heights, Ohio. . . . **William Hawley** of Sudbury, Mass. died in June after a long illness. He was a sales engineer in the construction industry until illness forced his retirement three years ago. He is survived by his wife, Joan (Hayes); two children, William and Judith; his father; and his sister. . . . **John Reddersen**, of Potomac, Md., died in March.—**Virginia Grammer**, Secretary, 62 Sullivan St., Charlestown, MA 02129

# 48 35th Reunion

Gloria and **Sonny Monosson** invited classmates from Texas to Boston to the latest 35th Reunion warm-up cocktail party. **Tom Pawel** and **Jack Page** called from their homes in Texas to express their regrets at missing the party. **Harry Jones** (N.J.), **Gordy Johnson** (Va.), **Ken Brock** (N.Y.), **Irving Kagan** (Maine), and **Phil Bragar** (N.J.) called and wished everyone a good warm-up party. Twenty-two classmates and their wives were at the Monossons. They were **Jim Pastoriza**, **Stan Abkowitz**, Sophia and **Bernie Gordon**, Judy and **Graham Sterling**, Margie and **Bob Welsh**, **Nick Prasinos**, **Manny Kramer**, Beverly and **Dave Friedman**, Gloria and **Herb Lipson**, Jean and **Milton Slade**, Barbara and **Mal Reed**, Adelle and **Norm Zimbel**, Eleanor and **Harry Ottobrini**, **Stan Shein**, Evelyn and **Herb Kurinsky**, **Nancy Noble**, **Rose LaFreniere**, **Dotty Seltzer**, Ginny and **George Clifford**, Martha and **Bill Katz**, and yours truly.

Planning for the 35th Reunion has consisted mainly of the warm-up cocktail parties and expressions of interest from the party-goers in continuing the party at the Chatham Bars Inn. I called the Inn and our reservation is for Friday and Saturday nights, June 10 and 11, 1983. On Saturday we will have options for using the beach, boats, tennis courts, and golf course. In the evening there will be a cocktail party and dinner followed by dancing. Thursday night and Friday morning, June 9 and 10 there will be activities on the M.I.T. campus. On Thursday evening a buffet is scheduled followed by the Boston Pops. Friday lunch has been moved from Rockwell Cage to the new Athletic Center. The dormitories are available June 7, 8, and 9 for our classmates.

I don't remember the cliche that suggests that if you are going to make a mistake you may as well make a big one. I tried to remember that cliche after a recent letter from **Denny McNear** informing me of an error in my column in the October 1982 issue of the *Review*. During the 19 years as class secretary, I am sure that I have misspelled many names, abused English grammar, and distorted the details of the news about our classmates. Denny explained that my latest gaffe was to change his wife's name. My apologies to Susan, Denny, and to Denny's friends who called to ask Denny about his new wife. The correct facts at that Denny's wife is Susan, and she is from El Paso, Tex. **Harry Ottobrini**'s reaction to this recent mistake was to remind me of the time I wrote that he had bought a toothpick factory in Vermont after he had told me about considering buying a company that makes crutches from pressed wood.

The Alumni Officers' Conference in San Francisco on September 24 and 25 was well attended by the Class of '78. **Denny McNear**, president of the M.I.T. Alumni Association, said during his address to the conference that during his tenure as president he hopes to work with alumni to increase the diversity of activities sponsored by alumni in their own geographical areas. In addition to educational counselors, club events, and the Alumni Fund, the Bay area activities include a seminar series and an enterprise forum devoted to the needs of new companies. Denny expects that the type of alumni activity will vary with the interests of the alumni in the area. Some interest exists for sponsoring sports programs, Sunday brunches, and picnics.

Other classmates at the conference were **Jack Page**, **Leo Celniker**, **Milton Kamins**, **Pete Richardson**, **Lou Kreek**, **Phil Lally**, **Jacques Kourkene**, **Don Marshall**, **Arthur White**, and yours truly.

**Phil Lally** has worked on traveling wave tubes at Teledyne MEC for many years. He recently spent six weeks in Germany on a technology transfer program at Telefunken in Ulm. Phil's wife Mary Ann grew up in Scituate, Mass., and Phil started in June 1973 at M.I.T. Their three sons include an engineer, a financial analyst, and an entrepreneur. The engineer works on digital telemetry at Northern Telecon; the analyst is at Teledyne; and the entrepreneur is developing a business involving bicycles. . . . **Jack Page's** company has successfully marketed their steam boiler to the prefabricated concrete industry. Jack showed the boiler to me during my recent visit to Dallas. After burning natural gas, this boiler has no smokestack, no waste heat. The products of combustion are mixed with water and all the energy is used to make steam. The next market that Jack is pursuing is the heating and bonding of grain into pellets for animal feed. . . . **Leo Celniker** has been at Lockheed's skunk works since 1951. Some earlier projects included the U2 and the SR71 aircraft. At our 50th Reunion, ask Leo to tell you what projects were active in 1982. Leo's wife, Phyliss, is working on a degree in psychology and gerontology and specializing on working with people who have elderly parents. Their son received a bachelor's and master's from M.I.T. and he works for Schlumberger in Houston, Tex. His career is progressing rapidly and he has few personal responsibilities, so he is wondering how long his sybaritic life will continue. Recently this son brought his girl friend to Los Angeles and asked his parents to have a family party with grandma, aunts, uncles, and cousins to meet his girl friend and give their approval. Leo and Phyliss' oldest daughter has a Ph.D. in genetic biology and another daughter teaches handicapped children. Leo asked if I could get some news about **Stan Fingerhut** and **Ben Brettler**. (I'll try.) Leo has helped the Alumni Fund organize and conduct telethons in L.A.

Gwen and **Lou Kreek** enjoyed sightseeing while in San Francisco for the conference. Lou is a member of the committee that planned this year's Alumni Officers' Conference. Gwen is president of her Wellesley class, and they are busy planning their 25th Reunion next June. Recently Gwen prepared a crossword puzzle using professors' names. Her puzzle was on the cover of the Wellesley alumni magazine. Gwen is president of the Wellesley club in Wilmington, Del. Their members paint canvases and assemble materials needed for needlepoint projects. The kits are sold and the proceeds used to support the club's activities. Gwen showed me an intricate pattern of the Wellesley seal that she paints on canvas.

**Milt Kamins** is at the Rand Corp. in management systems science. Milt earned an advanced degree as a mechanical engineer from Caltech while there on a fellowship in 1957. His specialty is logistics with an emphasis on reliability and support. They have developed a computer model to calculate the probability of failure after repeated operation of a type of aircraft. Improved programming with random access memories and abbreviated codes have enabled them to reduce the cost of simulating an aircraft sortie from twenty cents to one cent. After many iterations, possible because of the lower costs they have calculations for helping determining stocks of spare parts and frequency of scheduled maintenance. Their efforts are to achieve an affordable way of improving survivability under wartime conditions. Milt's son graduated from Caltech with a dual degree in biology and math. Another son is a senior in biology and is planning to be a dentist.—**Marty Billett**, Secretary, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

# 49

"To honor a person for preeminence in the field of food technology": these are the requirements for the Nicholas Appert Award presented this year by the Institute of Food Technologists to **Clinton O. Chichester**. Our classmate is a professor at the University of Rhode Island. This award is the latest of many earned by this esteemed and active member of his profession.

Grandparentage becomes common now to us '49ers. It is a pleasure for your secretary (four times) to welcome **Stan Margolin** (first-time, November 1981) and **Harry Lambe** (first time coming in April 1983) to this doting group. Are there any others? Anyone with more than me?

**Charlie Sutherland** writes to second my motion for our next reunion to be held again in Bermuda. Charlie's got three of his four daughters in college. He probably needs to get away from the monthly bank statements, if he's like me with my four daughters.

35th Reunion: June 1984. Time to prepare! **Harry Lambe** and **Stan Margolin** called to divulge news. **Demetre P. (Mickey) Ligor** and his wife Pam are chairmen for our 35th. Locations on the list are Harborside Inn, Martha's Vineyard, Chatham Bars Inn on the Cape, spots in southern Maine and BERMUDA. (Please note biased capitalization). Mickey and his committee are considering, negotiating, and evaluating. I hope they will soon be communicating. Do you remember that slogan from the past—at our 15th—at the Belmont? "Candy is dandy, but Ligor is quicker! Here's that man, Mickey, again! Nice talking to you.—**Paul E. Weamer**, Secretary, 331 Ridge Meadow Dr., Chesterfield, MO 63017, (314) 576-9919

# 50

In July 1982 Corning Glass Works, located in Corning, N.Y., announced six appointments in Corning Engineering, a unit of the company responsible for the sale of technology worldwide. Corning Engineering consolidates into one group the people and projects relating to technology sales that had existed previously in different parts of the company. Among the appointments was **Donald E. McGuire**, director of engineering. Don joined the company in 1955. Since 1981 he had been manager of television engineering and international projects in the electrical and electronic products division. . . . **Richard M. Dillon** tells us that after graduation he spent ten years in structural engineering design and consulting. In 1960 he was appointed dean of engineering science at the University of Western Ontario. In 1971 he entered Ontario public service as deputy minister of energy and deputy director of municipal affairs and housing. He resigned in July 1982 and is now consulting in the field of public policy. . . . **Frederick F. Sadri** is presently director of architecture at

Odell Associates, Inc. in Charlotte, N.C., an architectural engineering firm doing major corporate and industrial work on the Atlantic side of the U.S.

Colonel **James R. Butterworth** retired from the United States Army in August 1982 after 32 years of military service. He spent the last five years at the Defense Electronics Supply Center in Dayton, Ohio, first as director of supply operations, then as director of the office of planning and management. The colonel, wife Kee Hee Lee, and daughter Lisa Emily will remain in the Dayton area, with Colonel Butterworth taking a position as a senior analyst with the Systems Evaluation and Configuration Management Group of Analytics, which provides support to managers in government and industry responsible for planning, development, production, fielding, and life cycle support of defense and civil systems. He served as commander and senior staff officer at various army installations, including a tour in Vietnam as an evaluation and analysis officer with the U.S. Military Assistance Command and in Taegu, Korea, where he commanded the U.S. Inventory Management Center, while serving in a dual capacity as assistant chief of staff for material, 19th Support Command. Colonel Butterworth's decorations include the Bronze Star, Meritorious Service Medal, Joint Service Commendation Medal, Army Commendation Medal, and numerous service and campaign ribbons.

**Robert L. Plouffe** has been named executive vice-president of PRC Government Information Systems, one of Planning Research Corp.'s four operating groups. Bob, previously president of the systems division of Computer Sciences Corp., is responsible for direct management of program development, as well as for overall management and direction of new business acquisition activities for the PRC group. He holds 14 U.S. patents, several of which resulted in products sold worldwide. Bob, his wife, and three children live in McLean, Vir.

We are sorry to announce the death of **William E. Krag** of Lexington, Mass., who passed away on August 26, 1982. Dr. Krag was a physicist at Lincoln Laboratory and had been a member of the Lincoln staff since 1952. His most recent research was at Lincoln's Experimental Test System in New Mexico, where he supervised development of electro-optical sensor systems for space surveillance. Dr. Krag is survived by his widow, Phyllis Bader Krag; his mother, Edith Olson Krag of Holden; two daughters; and two sons. If anyone plans to donate a memorial to Dr. Krag, Mrs. Krag has requested that you specify the memorial donation be used in landscaping the Medical Building at M.I.T.—**John T. McKenna**, Secretary, 1 Emerson Place, Apt. 11H, Boston, MA 02114

# 51

**Carl N. Graf** is president and chief operating officer of W.R. Grace and Co., a position he was appointed to in 1981. Carl joined Grace's Dewey and Almy Chemical Division in 1953, following his graduation from Harvard Business School, and was executive vice president and sector executive for Grace prior to becoming president. . . . **George N. Butzow**, chief executive officer of MTS Systems, a manufacturer of testing and analysis equipment in Minneapolis, was named to the additional post of chairman. . . . **Larry Kuszmaul** left the Arundel Corp. in 1981, after 23 years, when they decided to dissolve their heavy construction division and join the Mass Transit Administration division of the Department of Transportation, State of Maryland. . . . **Robert Shaffer** became chief engineer for Campbell-Hansfeld Co. in January 1981.

**Jack Barcinski** is executive vice president at Mead Foods, Inc., a regional food firm headquartered in Dallas. His son Derek is an architectural student at Rice University.

**Murray D. Sirkis** writes, "I am professor of engineering in the College of Engineering and Applied Sciences at Arizona State University in Tempe, where we have been since January 1969. This year, along with the usual academic chores, I have another that is proving to be quite interesting: my colleagues at the University have elected me chair of the Faculty Assembly. Our daughters, Judy and Lauren, are out on their own. Judy, the older, is an attorney in nearby Phoenix, and Lauren, the younger, became a bride last March. Dee and I are not ready to give up the old homestead, however.

**Roy Weinstein** received an honorary Doctor of Science degree from Lycoming College, where Roy addressed a convocation in 1981 on the subject "Physics and the Unity of Knowledge." Roy has been chairman of the Physics Department at Northeastern University since 1960 and currently is the Pi Kappa Phi national scholar. He taught previously at Brandeis University, M.I.T., and at the Institute for Theoretical Physics in Copenhagen as an N.S.F. Fellow. He has been a visiting scientist and Guggenheim Fellow at Stanford University, and an N.S.F. Fellow at Harvard University. He was elected a Fellow in the American Physical Society in 1967. Over his career, he has consulted to numerous corporations and companies, and written more than 100 papers, books, and abstracts.

**William F. Steagall** reports his retirement in 1981. He has acquired some 19 patents in his career with UNIVAC, RCA, North American Aviation, and System Development Corp. He and his wife Barbara live at 1023 22nd Street in Santa Monica, where they enjoy sailing their 36-foot sloop, hunting, hiking, shooting and the restoration of a 1963 Lotus-23 sports racing car. . . . **Paul N. Malherbe** elected to retire from Mobil Oil in September 1979, after 28 years, and has been engaged since then as marketing representative for an international oil trading company. . . . **John B. Aycrigg** is now hospital clinical director for Bethesda Hospital in Denver. . . . **Edward L. Bronstein** has purchased Spencer Boat Co. in Palm Beach, Fla.

**William J. Sullivan, Jr.**, reports: "After traveling the world for over 25 years in commercial sales for Boeing, I am taking early retirement and may embark on a new or different career following a period of rest and recreation. Maybe put a few miles on my just restored Silver Cloud." . . . **Robert L. MacCallum, Jr.**, joined Unimin Corp. in New Canaan, Conn., in October 1981, as senior vice president/sales. . . . **Clarence Gregory, Jr.**, writes, "In December I was able to get together briefly with **Oscar Falconi**, **Pete Lang**, and **John Morgenthaler** in the San Francisco-Oakland Airport. Oscar and John now have their own businesses, Pete works for the U.S. Department of Energy, and I am still with the General Electric Co.'s Knolls Atomic Power Laboratory."—**Gregor J. Gentleman**, Secretary, 818 Southwest Ninth St., Des Moines, IA 50309

# 52

An approaching deadline with nothing to report made it doubly pleasant to receive a clipping from the New Britain (Conn.) *Herald* and a press release from Emhart Corp., both announcing that **John S. Rydz** has been promoted to vice president/technology for that company from director of productivity. Emhart is a diversified manufacturer of hardware, adhesives, electrical components, and especially machinery—for making shoes, glass and gears, and for stuffing circuit boards—with plants all over the world. To judge from the picture in the clipping, John is approaching his new duties with a degree of solemnity, arising perhaps from experiences as a vice president; he has held that title before, at the Sewing Products Group at Singer Co., Diebold, and at NUCOR. Before that he was with RCA's Industrial Product Group. His responsibility in these positions has been to apply new technology, particularly electronics, to his company's operations and products. At Singer, for example, he led the effort that produced the electronic sewing machine. That is the sort of achievement many of us would like to have in our record against the day (at some reunion, say) when we corner an unwary passer-by and try his good manners by explaining how something we did in our career actually made a difference: in a project carried out with expedition and secrecy, the design of an old product was revolutionized—thus lowering costs, improving performance, and fending off hard-pressing competition (at least for a while).

With new technological opportunities appearing everywhere, I imagine that in New Britain, Conn., and Beverly, Mass. people who thought they were mechanical engineers are now studying to replace cams with OR operations, keys with ANDs, and gear chains with flip-flops.—**Richard F. Lacey**, Secretary, 2340 Cowper St., Palo Alto, CA 94301

# 54

Happy New Year to the Class of 1954. One good New Year's resolution we can make is to attend the 30th Reunion, which is only a year and a half away. **Bob Warshawer**, who was unanimously re-elected chairman of the Reunion Committee, promises another exciting get-together. So start planning, especially if you're a long way from Cambridge, to attend the 30th Reunion and help make it even more successful than the 25th.

Congratulations to **Phil Sayre**, who was appointed president and chief executive officer of Balzers U.S.A. Phil, who is a retired Air Force colonel, was previously president of the Sprague Meter Division of Textron. . . . Our favorite M.I.T. president, **Paul Gray**, was elected a member of The Conference Board. Founded in 1916, The Conference Board is a global network of leaders who exchange information on management, economic and public policy issues. . . . **Arthur Evans, Jr.**, recently accepted a position at Tartan Laboratories, a new venture capital firm that produces computer software. . . . **David Myers** is a senior project engineer at Nova Biomedical in Newton, Mass. . . . **Frederick R. West** taught astronomy at the University of Alabama, Birmingham, this past summer.

We are saddened to report the deaths of two of our classmates, **Sylvan Sacolick** and **Carl Mathews**. Dr. Sacolick, a physician, died in Israel on February 8, 1980. Carl Mathews, a retired Coast Guard commander, was a program manager for advanced satellite navigation and communication systems with the Maritime Administration.—**William Combs**, 120 West Newton St., Boston, MA 02118; **John Kiley**, 7 Kensington Rd., Woburn, MA 01801; **Louis Mahoney**, 52 Symor Dr., Convent Sta., NJ 07961; **Dominick A. Sama**, 28 Chestnut Hill Rd., Groton, MA 01450

# 56

I received the following note from **Hal Friedman**: "After the 25th Reunion last year, a few of us got together at Martha's Vineyard. We had such a good time, we decided to continue the 'tradition.' Six of us made plans to meet again in 1982. The **Bob Greenes**, the **Tom Hoffmans** (who did all the work), and my family had our own mini-reunion in Ocean Isle, N.C., in July 1982. Unfortunately, the other three families could not make it. But we are encouraged and will try again in 1983. We heartily suggest that small circles of M.I.T. friends try to maintain contact. It was fun to be together with people who have had such a significant impact on our lives." According to the 25th Reunion Directory, Hal lives with his wife, Laura, and their No. 3 son and No. 1 daughter in Attleboro, Mass. No. 1 son is married and is in the U.S. Air Force; No. 2 son is now a sophomore at U.R.I. As president of Polymetallurgical Corp., he claims "malingering" to be his principal occupation, and "remaining solvent and staying out of jail" as his most noteworthy accomplishments.

*Honors and Kudos*: **Richard Unruh** of Eugene,

Ore., was appointed architectural representative to the Oregon Energy Conservation Board by Governor Vic Atiyeh. Dick's four-year term began on July 1, 1982. Duties of the board include establishing basic and uniform standards to provide maximum energy conservation in buildings and other structures. . . . **Bruce D. Wedlock** has been elected to a two-year term as a director of the IEEE. He is one of ten regional directors, and will represent New England, New York, and New Jersey chapters on the IEEE Board. Bruce is also director of the Lowell Institute at M.I.T.

*Professional Career Notes*: **Ronald C. Clark** was named chief investment officer of the Putnam Management Co., Inc. In his new position, he will serve as chairman of the Investment Policy Committee, which establishes overall investment strategy for the 14 mutual funds managed by Putnam. . . . **J. Robert Mansperger** recently completed a four-month tour as a research associate at the National Bureau of Standards, where he was sponsored by his present employer, Hardinge Brothers of Elmira, N.Y. . . . **Fred Worsh** was transfered by Corning Glass Works from Canton, N.Y. to Wilmington, N.C. He is now a senior project engineer in the development of optical wave guides. Fred is also living in Wilmington, and would welcome a call from any '56ers in the area. . . . **Nicholas J. Kiladis** is currently director of contracts for the Baltimore Mass Transit Administration, and informs us that he is "building the Baltimore subway." . . . After working several years in Libya, **Hank Valcour, Jr.**, will now be working in Saudi Arabia as sales manager for Ionics, Inc., a water desalting and treatment systems firm headquartered in Watertown, Mass. . . . **Bob Kaiser** (that's me) will be spending a little more time than usual at M.I.T. this year. While maintaining my position as president of ARGOS Associates, Inc., in Winchester, Mass., I will also be a visiting scientist in the Materials Processing Center, where I will be working with Professor Joel Clark and his students on an assessment of the long-term demand for materials by the automobile industry.—Co-Secretaries: **Robert Kaiser**, 12 Glengarry, Winchester, MA 01890, (617) 729-5345; **Caroline Disario Chihoski**, 2116 W. Davies Ave., Littleton, CO 80120, (303) 794-5818

# 59

If you notice a different style in this column, it is not just imagination. An unexpected opportunity has given June and me our second chance to live in the Far East, and it is with great pleasure that we pack our worldly goods and possessions and move to Tokyo for the next two to three years. In the meantime (or as long as my term as Class Secretary lasts), **George Barnett** and **Phil Richardson** have kindly offered to pinch-hit. The different styles arise as they add their comments. I'll still be contributing a comment or two, so I would appreciate your keeping me posted on class news. For those who wish to write, or to drop in if they are passing through, my new address is **L.E. Laben**, IBM World Trade Asia Corp., Masonic 39 Mori Building, 4-5 Azabudai 2-chome, Minato-ku, Tokyo 106, Japan; the telephone number is (03) 433-7731. My thanks in advance to George and Phil for their assistance, and in arrears to all who wrote in during the past few years. I look forward to seeing everyone at our 25th Reunion.

At last report, **Mike Nash**, who was executive vice president of IMN Energy Services Technology, Inc., has become president. . . . From the world of sports, we are advised that **Bill Widnall**, still hanging around the Institute as a professor in the Department of Aeronautics and Astronautics, is also still winning sailboat races. He recently won the world championship in the International One Design Class for the fifth time. . . . **Neil Bernstein** has become president and chief operating officer of RSC Industries, Inc., Hialeah, Fla. . . . **B. John Yeager** is retiring as a director of Cincinnati Gas & Electric Co. . . . **Edward W. Cheatham** recently returned from Europe to become director of corporate public relations for Sperry Corp. in New York City. . . . **Calvin Campbell** has acquired majority ownership of Goodman Equipment Corp., which manufactures underground mining locomotives.

Warning is hereby issued to all classmates that your temporary class notes reporter tends to be a little irreverent in handling news. In any event, I hope those of you who have thick skin will send lots of information about your current activites.—**George L. Barnett**, Acting Secretary, 90 Broad St., New York, NY 10004

# 62

**David N. Wormley** has been named head of the Department of Mechanical Engineering at M.I.T. David received his M.S. in 1964 and his Ph.D. in 1967, the same year he was appointed to the faculty. His research is in the areas of fluid power, transportation, and fossil fuel power plant systems. . . . **Albert L. Blackwell** has authored a book, *Schleiermacher's Early Philosophy of Life*, published by Harvard Theological Studies. . . . **Modesto A. Madique** has been appointed president and chief exeutive officer of Collaborative Research, Inc., a biotechnology firm with headquarters in Lexington, Mass. . . . **Herb Selesnick** and his wife Hinda Sterling have joined the staff of the Boston *Globe* as cartoonists, producing the business comic strip "Stockworth." They also run their own communications consulting firm. Herb's background for these endeavors includes three degrees from M.I.T.—B.S. in Physics, M.S. in Management, Ph.D. in Political Science—and 15 years of experience with a management consulting company. . . . **Dick Stein** is professor of physiology at the University of Alberta. His daughter Eleanor is starting medical school; he and his wife Sue also have a son Eric, adopted from Korea 14 years ago.—**John Prussing**, Secretary, 2106 Grange Dr., Urbana, IL 61801

# 63 20th Reunion

Greetings and salutations. Hope the new year is treating you well. Short column this month, but quite interesting—everyone in this month's column is in a new job.

**James Hamm** was elected president and chief operating officer of Vitramon, Inc. Vitramon makes miniature ceramic and porcelain capacitors used in electronic equipment. James has been vice president of operations for the equipment and ceramic divisions of Materials Research Corp. in Orangeburg, N.Y. Another classmate makes it to the top of the corporate ladder—congratulations! . . . **Howard Leibowitz** has been appointed director of manufacturing engineering of the Consumer Products Division of Corning Glass Works. Howard has been with Corning since 1965, and since 1977 was director of machine technology in the Manufacturing and Engineering Division. . . . **Steve Bram** was appointed vice president for fossil power by Consolidated Edison of New York. Steve had been vice president for systems and transmission operations.

One of our letters comes from **Larry Beckreck**. Larry is in a new job, in the same place (the Midlands of England). He is running a center to train young, unemployed "school leavers" about computers and electronics. The center is a non-profit business and will serve the community of Leicester with advice, "ombuds-service," videotext services, word processing services, etc. Larry says he is enjoying the challenge of his new situation. Julia is enjoying her latest project as well: renovating the house next door, which the Beckrecks bought this past year. Son Seth is into air scouts, personal computers, and trombone, while his younger brother Joshua's activities center on drums and girl friends.

Our other letter is from **Dick Males**, who is also in a new job, and also still living in the same place (Cincinnati). After nine years, Dick left Gates & Associates to become an independent consultant specializing in microcomputer information management systems and other computer support work. Dick reports that his family is all well. Son Nathaniel, 7, is in second grade, and Dick and Barbara spend a fair amount of time in school-related activities, as well as other community boards and groups. Nathaniel is doing well in school and playing soccer, as is his older brother Matthew, 16. Dick has retired from his karate lessons (though Matthew is still representing the family in that activity), and is pursuing more sedentary occupations, including taking clarinet and saxophone lessons, and brewing beer at home. If forced into physical activity, Dick opts for racquetball, swimming, and hoisting an occasional weight at the local Y.

Let me close with a commercial message. Remember our reunion—the 20th (can you believe that?)—coming up the weekend of June 10-12. Mark your calendar and plan to be there. Call a friend who hasn't been to a reunion before, and come together. More next month. Happy New Year.—**Mike Bertin**, Secretary, 18022 Gillman St., Irvine, CA 92715

# 64

Greetings '64! Only 18 months until our TWENTIETH! The great reunion countdown has begun. Even missing one issue (again!) we are still very short of news. Please write or send in your alumni fund envelopes!! Remember, if you don't, you will only hear about the trials and tribulations of the Schlosser clan.

Alumni fund envelopes (Thank you, all you worthy supporters of M.I.T.!) provided the following news. **John Shelton Reed's** latest book, *One South*, has just been published by the LSU Press. It's a collection of essays about the south written over the last ten years. . . . **Thomas H. Baker** is busy developing interactive graphics on Desktop Work Stations for integrated circuit designs for Hewlett Packard in Loveland, Tex. . . . In June 1981, **James Lerner** established his own company to specialize in wind energy development consulting. He is advising the city of Fairfield, Calif. in its plans to build a 100-megawatt wind project by 1985. James was awarded "Energy Conserver of the Year" for 1982 by the Northern California Chapter of the American Public Works Association for helping to make the Fairfield Wind Energy Project possible.

Now to the one press release. **Stephen Kraysler** has been named senior vice-president of Hanseco Insurance Co., Boston, Mass., a subsidiary of John Hancock. . . . **Ernest Cohen**, an engineer with the Foxboro Co., performed a clarinet solo this past summer at the Unity Church in Easton, Mass. He has sung tenor in the Unity Choir and performed in their concert series. . . . New publication: **Albert Teich** has edited an article for the American Association for the Advancement of Science (AAAS) entitled "Science, Technology, and the Issues of the 80s: Policy Outlook," which was scheduled to be published September 11, 1982. Dr. Teich is manager of science policy studies at AAAS and project manager of AAAS's five-year *Outlook* Project.

We are in luck this month—a class hero, **Engin Ekonomi**. Engin decided to write for the first time since graduation! After graduating, he attended the University of California at Berkeley from which he received an M.S. degree in 1965. Then he worked at Lawrence Berkeley Labs for two years. Between 1967 and 1981, Engin lived in Switzerland and Turkey where he was heavily involved in international trade. Engin is presently attending the University of California at Santa Barbara working toward a certificate in business management. He is married and has a four-year-old son. Good to hear from you. Don't wait another 18 years.

It is the middle of October at this writing.

George, our oldest, is five weeks from his day of triumph as center of attention, his Bar-Mitzvah. We, his parents, are in the final moments of preparation and arrangements, and are very much looking forward to the occasion. "See" you next issue.—**Steve Schlosser**, Secretary, 11129 Deborah Dr., Potomac, MD 20854

# 65

Happy New Year. I just got the first heating bill of the season and am devoutly hoping for a mild winter. For those of you sensible enough to live in the Sun Belt, I can only send Anne's and my envy at this time of year.

**Warren Anderson** writes that **Bill Brody** was involved in the development of multiple energy imaging, a new X-Ray technique, at Stanford University. Warren is organizing intra-operative sensory evoked potential recordings at a Portland hospital and says advice is gratefully accepted. He also says that he has rediscovered sailing twenty years after the Tech Dinghy, with enjoyment second only to his girls' (Shannon and Elise) recent mastery of the bicycle. Warren has been to no M.I.T. reunions yet, but after his tenth medical school reunion he is reborn into hedonism's subset nostalgia, and will be here in 1985. . . . **Ed Strauss** is presently a partner in the law firm of Berkman, Auslander, Pohl, Lieber and Engel in Pittsburgh. He specializes in S.E.C. and public finance work. Ed and Heni have two chilrden—Aaron, 9, and Rebecca, 5.

As for the Lipners, life goes on. I am moving to yet another Digital building—this one in Littleton, Mass. Home is the same.—**Steve Lipner**, Secretary, 6 Midland Rd., Wellesley, MA 02181

# 66

It is gratifying that people have responded to our appeal to share news about our classmates. Special thanks go to **George Berbeco**, who was responsible for reporting all the news for this month's column. . . . **Bob Kline** is a vice president at Management Decision Systems in Waltham, Mass. . . . Gail and **Sam (Bo) Pasternack** are living in Brookline, Mass. He is now a patent attorney in Boston. . . . **Steve Levin** is teaching physics at "The Farm" in Tennessee and evidently enjoying it every much. . . . **George Berbeco,** his wife Sandy and their three children live in West Newton, Mass. George is president of Charles Water Products, Inc., a company he started five years ago. They manufacture static control products used to shield semiconductors from the unpleasant effects of static electricity. He has developed an international market on several continents and has recently traveled to Brazil to be the featured speaker at a technical symposium. . . . The type of letter George sent is exactly what **Stu Vidockler** and I had in mind when we asked for participation in this column. I hope that others will be inspired to share news of friends in the class. Best wishes for a happy and successful new year.—**Joe Shaffery,** Secretary, 34 Hastings Dr., Fort Salaonga, NY

# 67

**Donald Paul** was recently promoted to Rocky Mountain Division geophysicist for Chevron U.S.A. in Denver, Colo. He will be responsible for all geophysical exploration in the very active overthrust and foreland basin areas. Don's previous positions with Chevron have been in research, seismic data processing, Gulf Coast exploration, and corporate technical staff. . . . **Ted Nygreen** has been named a senior vice-president and national director of marketing for Anistics Inc., Alexander Services Inc.'s risk management subsidiary. Before being named to his current position, Ted was managing vice-president of Anistics' Atlanta office. Ted and his family live in Princeton, N.J. . . . **Arthur "Paul" Amesse** is now with Computer Sciences Corp.'s Systems Group in Falls Church, Vir. . . . **Mike Rosenblum** writes that he and his wife Kiki are doing okay, although they are waiting out the garment center slump. Mike also supplied the news that Christie and **Larry Gottlieb** recently bought a house in Santa Barbara, Calif. . . . Linda and **Frank Walsh** proudly announce the birth of their first child, daughter Lauren Marie, on August 16, 1982. The stock market, apparently pleased with the news, rose a record 39 points the following day.—**Jim Swanson**, Secretary, 878 Hoffman Terrace, Los Altos, CA 94022

# 69

Another month with little information. I can't write if you don't communicate!

**Eric Wolf** completed his residency in dermatology at the University of Pittsburgh this year and has opened his own practice in Groton, Conn. Linda Denede, Eric's wife, is doing her residency in Radiology at Rhode Island Hospital in Providence. . . . **Michael Timko**, in his eleventh year with Analog Devices in Norwood, Mass., has been named a Division Fellow by A.D. and will be working on highly specialized design projects dealing with complex data acquisition components.

Meanwhile, our class has about 75 members for whom the Institute has no address! I will list a few of these classmates each month and if you know where they are, please let me or the Alumni Office know. For this month, missing members are: **Faisal I. Al-Sowayel, Kent T. Attridge, John C. Bell III, Barton M. Bresnik, Robert L. Buliszak, Anthony J. Carella, Thomas A. Caruso, George H. Chu, Paul Y. Chu, James M. Considine, James E. Cravens**, and **Oliver M. Dashwood**.

As to what I have been up to, all I can say is, "If you're prone to ulcers, don't get into publishing." It looks as if all three books I mentioned last column will be ready for the World Fantasy Convention next week, but Murphy has really been working overtime. I'll bring you an update on the convention next issue.—**Robert K. Wiener**, Box 27, M.I.T. Branch, Cambridge, MA 02139

# 70

**Andre Cappon** is presently involved in strategic planning in the financial industry for Booz, Allen & Hamilton in New York City. . . . **Lee Shaeffer** married Erika Solti and traveled to Hawaii on his honeymoon. Lee is a management consultant at McKinsey & Co. in Los Angeles. . . . **Frederic Campling** continues as assistant crown attorney in Hamilton, Ont. His family recently traveled to see Sue and **Ron Eisinger** in Charleston, W.V. Ron has completed his doctorate at the University of Illinois.

**Charles Kiefer** is president of Innovation Associates in Framingham. Recently, Charles was selected as a Mitchell Prize finalist. His essay deals with corporations that are changing their organizational structure to emphasize both performance and human satisfaction. . . . **David W. McComb** is a procurement specialist in the operations management union of Arthur D. Little. He recently spoke at a biannual forum sponsored by A.D. Little on industrial buyers being a major under-utilized resource in most manufacturing companies.

The University of California Regents announce the appointment of **Wendell C. Brase** as vice-chancellor of finance, planning and administration at the University of California, Santa Cruz. Wendell has been with U.C.S.C. since 1978 as chief financial officer in charge of accounting, budget, institutional planning, data analysis and facilities planning. He has previously been employed by J.C. Penney Co., Eastman School of Music, and University of Rochester's Laboratory for Lasar Energetics before coming to U.C.S.C.—**Robert Vegeler**, Secretary, Dumas, Burke, Backs, Salin, and Vegeler, 2120 Ft. Wayne National Bank Bldg., Ft. Wayne, IN 46802

*Wendell Brase, '70*

# 71

**Robert B. Stewart** has transferred to the aeromechanics branch of Sikorsky Aircraft after ten years as a test engineer. He is now a structural dynamicist. He and his wife Ruth Ann enjoy tennis, skiing, playing with their Alfa and RX-7, and investing in condominiums that go broke. . . . **Stan N. Finkelstein** has co-authored a book entitled *The American Blood Supply*, published by the M.I.T. Press. Other authors were Alvin W. Drake and Harvey M. Sapolsky. . . . **Michael P. Chrzanowski** and his wife Nancy announce the birth of their second child, Peter, who joins his sister Mary Ellen (3). . . . While in California I visited with Fred Horr, who is with Northrup. He has recently married. Also, I talked to **Fred Stamberger, Karl Overbeck, Del Knarr**, and **Kent Attridge**, but they were out of town when I was there. . . . My wife Lucy and I are proud to announce the birth of our daughter, Lydia Anne.—**Hal Moorman**, Secretary, P.O. Box 1808, Brenham, TX 77833

# 72

The social event of the decade passed into history this June when the class of '72 had its 10th Reunion. More than 90 class members—plus assorted spouses, friends, and offspring—attended an M.I.T. Museum reception, a roller skating party, Saturday at Endicott House, and brunch atop the new John Hancock tower (nee Plywood Palace). A decision was made to institute (no pun intended) a class gift to fund undergraduate research, through UROP. Details will be worked out by the class Executive Committee. New class officers are **Bonny Kellermann**, president, **Paul Levy**, vice president, **Steve Henry**, treasurer, and **Wendy Erb** and **Dick Fletcher** secretaries. Courtesy of **Dan Bloom**, we have the following superlative reunion attendees. *Traveled farthest*: **Paul Shimura** from Tokyo (semi-disqualified because he spends part of his time in Boston anyway), **Steve Chessin** and **Ron Crane** from California. *Lived in the most cities*: **Mark Mitchell**, that is Lieutenant Commander Mitchell, eight. *Most jobs*: **Wendy Erb**, so many she couldn't remember them all. *Oldest child*: Rebecca (daughter of **Paul**) **Lentricia**, 11; runner-up: Melanie (daughter of **Joshua**) **Goldman** 10. *Youngest child*: Haskell (son of **Andy**) **Mermell**, 17 days. *Most kids*: tie between **Steve Henry** and **Paul Lentricia** at three. *Married most often*: several classmates married twice; Dan recommends that more effort be put into this category before the 15th Reunion.

And now the news: **Robert Lindgren** has become a member of the board of directors of A.S. Hansen, Inc., a compensation, benefits and actuarial consulting firm. He is in their Chicago office. . . . **Craig Melin** is vice president for planning at the National Jewish Hospital/National Asthma Center in Denver. . . . **Mike Milner** is supervisor in the E.S.S. Software Development System Department at Bell Laboratories' Indian Hill facility. He lives in Napierville, Ill., with wife Palma and son John Nicholas. . . . **Robert Tutunjian** is mar-

**Boston area classmates:** *The Alumni Fund will be running a telethon to call the ten most recent graduating classes. Here's a chance to get reaquainted with classmates, meet other alumni, and help M.I.T. If you'd be interested in calling on January 24 or January 25, 1983, or if you'd like more information, call Rhonda Peck, '82, at (617) 253-8281.*

keting director for Amicon Corp. in Danvers. . . . **Michael Rowny** has been elected corporate vice president for ventures and special projects of Bendix Corp. . . . **Dave Siesinger** is a member of a group called "Appeal to Reason" and recently served a six-month sentence for criminal trespass in connection with civil disobedience protesting the Seabrook Nuclear Power Plant. . . . **Rafael Bras** received the Macelwane Award of the American Geophysical Union. . . . **Robert Finn** is working at Eastman Kodak after spending six years at Stanford. **Gary Stahl** is halfway through a three-year fellowship in neontology at Children's Hospital of Philadelphia and writes, "My wife Debbie interrupted her teaching of elementary school music to give birth to our first child, Adam, on March 1." . . . **Larry Lasky** reports, "Being board-certified in clinical pathology and blood banking, I became associate medical director of the Minneapolis War Memorial Blood Bank and have joined the University of Minnesota Medical School faculty. My wife, Susan Fuhrman, '75, finished her pathology residency and is an associate pathologist at Mt. Sinai Hospital and on the university faculty." . . . **Kevin Trangle** writes, "After my internal medicine residency, I began working as an emergency physician. I am completing a master's in health administration and have opened an ambulatory care clinic with some colleagues."

**Ken Kempson** has completed a year as law clerk to the U.S. Court of Appeals in Washington and has joined Covington and Burlington as an associate. He writes, "I will probably be practicing in tax and corporate work. After four and a half years I am again single, but shy as ever." . . . **Michael Cohen** reports, "I have (nominally at least) left urban planning and now work as a programmer/analyst for Wells Fargo. It's a small department with two small computers, so I do a wide range of things. I'm learning a lot about data communications and am busy trying to get diverse departments to pool resources and share systems." . . . **Douglas Coonley** reports "I enjoy raising my two boys, Kip and Brett, 7 and 5, and traveling to Europe with my wife Suzanne. I'm still working in the energy field, designing and consulting on design and construction of solar buildings. . . . **Lorenzo Lara-Carrero** writes, "I've spent the last two years doing exciting research in pure math (eigenvalues of the Laplacian) as a visiting scholar at the University of Maryland. My work follows the footsteps of, among others, M.I.T. Professors Guillemin and Melrose. I've been doing some applied math at N.I.H. on the morphology of yeast production. I now have a second daughter and am back at my permanent position in Simon Bolivar University in Caracas." . . . **Richard Robison** reports, "Since leaving M.I.T., I went to seminary, pastored a church in Queens for three years, and went to India for three months on a short-term mission with three small sons and a pregnant wife. Mary Jo and I celebrated our tenth anniversary last August and enjoy it more every year. Our fourth, born last October, is a girl. I am now studying linguistics at U.C.L.A."—**Dick Fletcher**, Secretary, 135 West St., Braintree, MA 02184

# 73

Very little news to report this month. **Steve Warsof** spent the 1981-82 academic year at King's College Hospital in London as the Dreyfus Fellow in prenatal research. Steve has recently returned to D.C., where he is a fellow in maternal-fetal medicine. He and his wife are expecting their first in December. . . . **Henry Feuerstein** is now an associate attorney with the New York City firm of Wien, Lane, and Malkin, specializing in real estate law. Henry married Elise Ann Meyer in October, and they are living in New York.

**Michael Knauer**, after nine years at DEC, is now on the Burlington, Vt. plant's long-range planning team, trying to keep DEC competitive in the late 1980s. Wife Kathy is teaching; Katie is in second grade; Tommy is in kindergarten, and Carrie's in nursery school. . . . On the home front, I'm supplementing my income by selling slabwood, keeping enough to keep Ruth and the kids warm.—**Robert M. O. Sutton, Sr.**, Secretary, 819 Buckingham Ct., Warrenton, VA 22186

# 74

Sheila and **E. Martin Davidoff** welcomed Laura Brooke into the world on June 19. Their birth announcement was priceless. . . . **Dave Withee** wrote an entire epistle on the back of his contribution envelope. Good to hear from you, Dave! He has left Junior Achievement to seek greener (read: better-paying) pastures. Dave won his state's Jaycee public speaking contest in May and was going to the national's in Phoenix in June. He ends his letter by calling us all "toads" and inviting us to call if we're ever in Iowa. (Do people actually live in Iowa?)

Our class executive committee has voted to donate the balance of our class' athletic fund contributions to a fund for the total rehabilitation of the weight-lifting room. The official new name of the facility will be "The Class of '74 Intramural Health Fitness Center," which immediately suggests a contest to find a better name. The plan calls for (among other things) new Nautilus machines, expansion of the room size, new floors, and trained supervision. Contributions you make to the Alumni Fund can be designated to this rehabilitation fund by specifying "Health Fitness Center" on the donation.

Joan and **Kenneth W. Miller** had a nine-pound, ten-ounce boy in February. He's returned to M.I.T. in the new management of technology program, leaving Corning after seven years there. . . . Greetings and salutations from **Holly Horton**, who recently quit Occidental Petroleum to accept a job with Chevron U.S.A. Holly, a geophysicist, recently bought a home in Danville, Calif., and is "ecstatic" to be back in the Bay area. . . . **Robert J. Tronnier** writes, in perfectly legible handwriting, that he's an anesthesiology resident at the University of Minnesota hospital. . . . **John R.H. Black** is still working at Charles River Associates in the gloom and doom of metals market analysis. He was planning to leave home in Newton to deliver a paper on ocean mining in, of all places, Hawaii in July. . . . For all you women from McCormick Hall's Third Floor East Suite, **Eve Hollander** has a request for news. She's thriving as a full-time mother and worker for charity. . . . **Dave Gromala** is working at the U.S. Forest Products Laboratory, doing research into how to better utilize our timber resources through improved wood construction techniques.

*E. Martin Davidoff, '74, works with his oldest daughter, Sherri Elizabeth, "a future prospect for M.I.T."*

**William M. Miller** is working at a start-up computer firm named Stratus Computer in Maynard. He is also an elder and adult Sunday School teacher in his church. . . . **Ted Kochanski** recently moved into a new home in Austin Tex. He's busily building arrays of detectors to study the x-ray emissions from the TEXT takomak. . . . An article in the *Washington Post* last May, talking about the problems of government professionals in finding employment in today's shrinking economy, detailed the plight of **Richard I. Cohen** who, with his M.I.T. Course XIV undergraduate degree and a master's from Princeton, sent out 175 job applications to receive only one interview invitation. According to the article, unemployed professionals can expect to look an extra week for every $1,000 earned annually. These are tough times for everyone.—**Lionel Goulet**, 34 Tremlett Sq., Dorchester, MA 02124; **Jim Gokhale**, 6 Pond Lane, Arlington, MA 02174

# 75

Da da da dum. And now the Class of '75 news, brought to you by the Massachusetts Tool or Die Co. . . . **Larry Schiller** started his own computer software company last year in Coral Gables, Fla. He specializes in CPA and accountant service software, service bureau processing, and computer sales of the Alpha micro. He is also playing violin for the Ft. Lauderdale Symphony and the Miami Chamber Players (you may recall that Larry was concert master of the M.I.T. symphony in 1973-1975).

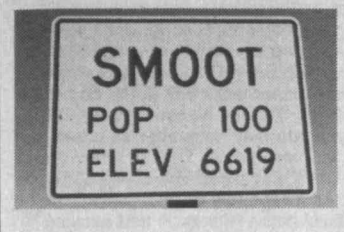
**Alan Levin** is still working at Oak Ridge National Laboratory on LMFBR safety; specifically, he is doing program planning for an experimental project on liquid sodium behavior at temperatures up to the boiling point. He has also obtained a professional engineer's license in Tennessee. He says that he "joined the ranks of the landed gentry (and the heavily indebted)" by buying a house two years ago. In his spare time he enjoys wine tasting and has started taking piano lessons. "This should come as no surprise to my fellow AEPi'ers, who probably got sick of my attempts to play the piano at the fraternity."

**Tom Durgavich**, his wife Linda, and son Matthew have left Massachusetts for Silicon Valley. Tom is now the speech applications manager at National Semiconductor in Santa Clara and living in San Jose. . . . Da da da Dum. Until next time.—**Alex Castaldo**, Secretary, 929 Mass. Ave. (12D), Cambridge, MA 02139

Finally, Class of 1978 would like to invite recent classes who have friends in '78 to please feel free to attend their reunion this coming spring. If you are interested, please contact Rita L. Russell, '78, at 86 Brooks St., Medford, MA 02155, or call (617) 395-6859. . . . That's all for now. Please feel free to call—(303) 599-0839—or write me.—**Barbara Wilson Crane**, Secretary, 6431 Galway Dr., Colorado Springs, CO 80907

# 77

Up until about four days ago, there were only a total of three notes from classmates to put in this column, and your secretary was beginning to wonder if it would be worthwhile to write a column




*While driving across country Jeslie Charmak, '76, passed through the town of Smoot. "Yes, Missouri, there is a Smoot, and it is alive and well in California," says Jeslie. Smoot, known at M.I.T. as a unit of measure for the Harvard Bridge, is derived from Oliver Smoot, '62, who was laid end over end to determine the length of the bridge in "smoots" while pledging Lambda Chi Alpha fraternity.*

at all. Fortunately, my husband, Mark Crane, '76, returned from a business/social trip back east with lots of news, and one person sent a nice long letter with lots of news. The letter arrived today, on the deadline, which is a little close for comfort. We really need to do better on getting news to your class secretary, so that there will be a column to read when you open your copy of the *Review*.

**Eileen Schaffer Vergino** met her (now) husband Michael at Livermore Lab in California. They were married August 22, 1981. Alumni attending the wedding included: Pat Fennessy, '78, who is now at Stanford working on her Ph.D.; Wendy Goodman, '75, who is now a practicing pediatrician in Forest Hills, N.Y.; Diane and Rick Stadterman, '75, Holli Jones, '75, and her fiancee (now husband), Major White. Eileen and Michael now have a daughter, Melissa Ruth, whom they both enjoy very much. Eileen is still working as a seismologist at Livermore Lab, and has started running again, although no marathons. She has also taken scuba lessons, and ran into Pat Peters, '79, in her class. Eileen's future plans include another child and getting her teaching credentials, with an emphasis on high school math and science.

**Alan D. Siggia** has now "made the big move to the country," from Arlington to Acton, Mass. Alan plans to finish his master's degree by December 1982 and then embark on consulting, radar meteorology, and house fix-up activities. . . .

*Bryan Ison, '77*

**Bryan N. Ison** received his M.B.A. from the University of Chicago in 1980 and has recently been appointed assistant investment officer of Travelers Investment Management Co. Brian joined Travelers in 1980 as a financial analyst, and lives in Rocky Hill, Conn.

**Samuel Gasster** is still working toward his Ph.D. at U.C./Berkeley—"a never-ending battle for truth, justice and the American way." Samuel spent three enjoyable weeks last November touring the People's Republic of China. . . . Lieutenant **Steven P. Gaskin** is now a second-year master's student at Sloan, taking most of his courses at Wellesley.

My husband Mark attended the wedding of Dan Jablonski, '76, to Jan Trimble, on October 2, 1982 in Bethesda, Md. Dan is doing basic research and development for the U.S. Navy, and will have received his Ph.D. from Cambridge in November. His wife Jan is from Georgia and works for an econometrics firm in Washington, D.C. Also present to celebrate the wedding were: **Cynthia Cole**, presently at Comsat in Washington, D.C.; **Dan Leighton**, who is working at DBM in New Jersey; Linda Lampron, who has completed her military tour of duty; Jim Moody '75, now an attorney working to defend General Westmoreland in the Westmoreland vs. CBS News case; Karen Altman, '78, now married and living in D.C.; Caren Penso, '78; Jeff Halis, '76, who is living in New York City and working for Merrill Lynch; and Ken Hall, Course VI graduate. . . . While in Boston, Mark also saw Cheryl Marceau, '76, who is now a personnel manager for Sylvania Technical Institute in Massachusetts, and Cathy Lu, '76. Cathy is in the process of changing careers from urban planning to computer science, presently studying at M.I.T. Her husband, Keith Nishihara, '79, was away in London giving a paper.

## 78 5th Reunion

COME TO THE REUNION!

It's been an auspicious four and one-half years since we graduated from La Tute, so we're planning a reunion party to celebrate. For the sake of convenience, the party will be held in Topeka, Kans. at a bar near the railroad depot.

Can't make it, you say? Well, fret not. We're going to have another reunion to celebrate our fifth year of freedom from Mama 'Tute. Those of you who can't make it to the party in Topeka will be expected in Cambridge, June 9-12 for the lesser festivities of a 5th Reunion.

But, I digress. I'm supposed to be writing a gossip column and we do have some gossip for you. Let's start with corrections. **Mike Harlan** recently called me to discuss my other alma mater, the University of Michigan Law School. Mike was going to start as a first-year law student this fall, but he got cold feet. He decided to take the easy route and go to Stanford Business School instead. (By the way, on Mike's way from his navy ship on the Mediterranean to Palo Alto, he stopped long enough in New Jersey to send me a wonderfully boring postcard of the New Jersey Turnpike. Thanks much, Mike.)

Another correction from a prior column. **Diane Curtis** called me today to tell me that I had baffled her entire company when I wrote to say that Diane was the project manager of a secret product about to be produced by the company that brought you Visicalc III. In fact, Diane is the product manager of a no-longer secret product (called TK!Solver) made by the company that made Visicalc. Everybody at her firm wanted to know what Visicalc III was, and she was very nearly accused of working for another company. Diane's big news is that she is buying a house in Cambridge—near Harvard Square—with a friend. They'll be splitting a two-family with Diane's cat and dog. Diane will be coming to the reunion

And so will you!

I'm sure **Eddie Nadler** will be at the reunion too. Eddie has recently left Intermetrics in Cambridge (where he worked on the space shuttle navigation software), and is now an applied math graduate student at Brown University in Providence, R.I. He recently passed his qualifiers and is now beginning his thesis research. His wife, as of June 1980, the former Eileen Henry, teaches in Providence. Eddie asked me to say, "Hello C-entry, wherever you are."

Our unofficial class secretary for southern California, **Sue Kayton** sent me one of her wonderful tomes. To begin with, Sue got married to an engineer turned lawyer named Michael Barclay and they bought a house in west Los Angeles. Of course, **Julie Kozaczka** went out for the wedding last January (Jule is still hanging around in the Cambridge general area and is helping to plan the reunion. Are you?) Sue is designing communications satelites for Hughes Aircraft, but they sent her back to school—University of Southern California for an M.S.E.E. in communication. Sue is impressed with the football team, but that admiration does not reach to the engineering school. Hughes also sent Sue to interview at M.I.T. to recruit seniors. "What a bizarre experience! I kept feeling that I was on the wrong side of the interviewing table." Also at Hughes are **Maurice Halmos**, **Janet Freeman** (and her husband Peter Cunningham, '77), while Sue reports that **Peter Spitzer** is also in L.A., having completed his internship and now working on computer applications in the medical field. . . . More from Sue: "I'm still doing volunteer work for the Educational Council, talking to applicants about M.I.T. It's very rewarding work and I heartily recommend it to everybody. Just think, this way you get to spread your *own* lies about the Institute instead of the applicants having to read them in some handbook. It's always fun when an applicant asks if everybody studies all the time or if they ever have waterfights—or when they ask if the Institute makes you take freshman English. Willing victims should contact the Educational Council directly (617) 253-3354 or M.I.T. Room 10-186. Try it; you'll like it." (Ed's note: I've done it too, and Sue is right.) . . . One last note to Sue: Thanks for your entry in my boring postcard collection—the Eastern Mennonite High School in Harrisonburg, Va. To the rest of you, send boring postcards! Maybe I'll display them at reunion. . . . So you'll just have to be there.

Now, out to the distant world of Silicon Valley and the lotus flower, where **Ronnie Lipschutz** is a staff scientist in the energy performance of buildings group at Lawrence Berkeley Labs conducting research in residential energy conservation. Ron is coauthor of *Energy Saver's Handbook For Town and City People*, published last March. . . . **Stella Perone** recently got her M.B.A. from Berkeley but didn't report where she went from there. . . . **Brian Berkeley** writes that he "is working as a development engineer for Data Terminals Division of Hewlett-Packard. I enjoy the skiing, running and sailing on San Francisco Bay and going to the beach."

Also in California is **Elizabeth Kendall**, who just got her master's at Caltech and is preparing for her oral exams for her Ph.D. . . . **A. David Stuart** works for Hughes Aircraft in Culver City, Calif., in the design of position control systems for IR sensors. . . . And **Mark De Lemos** just finished up his fourth year in Berkeley's Ph.D. program in mathematics. . . . **Tom Schneider** writes that he is a graduate student working toward a Ph.D. in molecular biology at the University of Colorado. "We have been studying the signal sequences that tell a ribosome where to start making protein. Our project involves recombinant DNA and biochemistry to produce data for computer analysis.". . . **Jeff Pollack** recently left Arlington, Va., where he was with American Management Systems, to move to Superior Oil in Houston, Tex., where he will create a new cash management system. . . . **Robert Maresca** seems to be a little short of time, as his note will demonstrate: "I've received an M.S.E.E. from Stanford after a B.S.M.E. from M.I.T. I'm now working in Phillips Research Labs in New York and have been developing magnetic suspension systems and control systems for magnetically suspend" (I'm holding a contest for the person who can best finish that sentence—preferably Bob himself. The winner gets a boring post card. . . . Speaking of boring postcards, I haven't gotten any from you folks in a long time. A postcard from a parking lot of an airport will do.)

Our military classmates have a lot to say this month. **Drahomir "Mike" Lazar** writes that he graduated from a training program for naval flight officers and was winged June 1980 at Naval Air Station, Pensacola, Fla. He also completed replacement radar intercept officer training in the F-14 Tomcat fighter at Fighter Squadron 101, NAS Oceana,

Virginia Beach, Va. August 1981. Then he spent two months this past fall in San Diego completing low level navigation and reconnaisance training. He is currently assigned to FITRON 32 at NAS Oceana, due to deploy on *U.S.S. Independence* in June 82. He also owns a townhouse and resides in Virginia Beach. . . . **Bob Licklider**, this month's other military reporter, writes, "It's hard to believe I have "only" 22 months left in the army. Seems like just yesterday that I was flying to Ft. Belvoir from Boston to take my place in the Corps of Engineers. Fort Leonard Wood is a fantastic place to be assigned to if you like solitude. I am very much looking forward to graduate school when I get out."

**Tim Buehrer** writes, "Since being graduated from M.I.T. in '78, I have attended Harvard Law School and the Kennedy School of Government. I graduated in June 1982 with a J.D. and an MPP. This June I was married to Carol Walker who also graduated from the Kennedy School with me. I'm now working for the law firm of Pierson, Semmes, Crolius, and Finley, and we are living in Arlington, Va." . . . From Evanston, Ill., writes **Ed Michelson**, who just got his M.D. from Washington University in St. Louis. Ed is at Northwestern University Medical Center in a combined internal medicine and emergency medicine training program. . . . **Scott Prey** and **Marrianne Unger Prey** just bought their first home this past March. It's in Baldwin, Mo. Marrianne graduated from the University of Illinois Medical School in June and is now doing her residency in pathology at Washington University in St. Louis. Scott is still at McDonnell Douglas and loves his work. . . . A brief note from **Brad Albom**: "I'm currently doing computer process monitoring work for Chevron, still in Richmond, Calif. I'm extending my real estate 'empire' and should be ready to retire before 30. In my spare time (what spare time?) I've started a computer products company (software/accessories), but it's too soon to tell if it's going to survive. I hope to make it back for the 5th Reunion."

Brad will be there. Will you?

I have some other news that I'm very excited about. Two of my favorite people from M.I.T., both fraternity siblings of mine, have had a beautiful baby. I have a hard time imagining that Catherine Rhea Nolet could have better parents than **Teresa Costanza Nolet** and my good friend Dan, '77. A warm, if somewhat public congratulations. . . . I had lunch recently with **Joan Olsen**. Joan is back in Beantown, working for a construction firm in downtown Boston. . . . The grapevine tells me that **Donna Palmer** has finished podiatry school and is now doing her internship in Manhattan. . . . **Linda Dornbusch** recently married a co-worker at Polaroid in the Boston area. . . . **Tim McMahon** and his wife Cindy live in their newly-purchased home in Wayland. Tim, who just got his M.B.A. from Chicago, is working as a consultant for a venture development corporation.

One last note about the Reunion. In order to make our reunion a success, we need everybody's help—at least in moral support. If we get ready, get psyched NOW, plan to go well in advance, talk to our friends and get them to go, to want to go and to have a good time, we'll have the best damned reunion that ever happened in Cambridge. (And that includes that other school in Cambridge—uh—er Lesley College.) So think about it now. Call your friends. Call me or **Karyn Altman**, our social chairperson, or call your travel agent. Plan your June around it NOW! Karyn may be running the show, but it's up to us, to make it a great time or just a pleasant trip. I may even display my boring postcard collection. (I don't know if that's a threat or an incentive.)

Well, that leaves news of me. I've got two small tidbits, but hell there's a little room left. The first is that I finally got a decent job as a lawyer in a field that I enjoy. I'm now a staff attorney at a Massachusetts Health Care Agency called the Rate Setting Commission. I start there in a couple of weeks. In the meanwhile, I get to interview for my own replacement. Talk about being on the wrong side of the interviewing table. . . . The other news about me is my recent marriage. Yuko Takagi and I got married in a small ceremony on a beautiful September day, in beautiful Hanover, N.H. The leaves were just beginning to turn, the sky was blue, and the bride was (and still is) beautiful. (Then, on the honeymoon I ruined my father-in-law's transmission. Oh well.) So, for this month, this is your secretary, wishing you all snow only on the ski slopes and sunny winter afternoons.—**David S. Browne**, 50 Follen St., Apt. 104, Cambridge, MA 02138 (617) 491-5313. P.S. Come to the reunion.

# 79

Greetings, faithful throng. Welcome to yet another scintillating year of the Class of '79 News (also know as "All the News that Fits, We Print!")

**Joan Sienkiewicz** has been given the honor of the title "Mistick River Business and Professional Women's Club's 1982 Young Career Woman." Joan has been employed since graduation at Electric Boat in Groton, Conn. Here duties include responsibility for submarine structure, design, and construction engineering support, primarily on the Trident class submarines. Congratulations, Joan! . . . Many more congratulations are in order. **Brad Myers** was recently married to Bernita Rabinovitz, a local Pittsburgher. Brad came to Pittsburgh to work as a senior software engineer for the Three Rivers Corp. (bonus points to any reader who can name the three rivers!). . . . **Bob Stall** wrote to say that he was planning a September 12, 1982 wedding to Merecedes Bitton, after which they planned to honeymoon in Hawaii. Bob was then off to Bethesda, Md., for an NIH med school elective called "Computers in Clinical Medicine." In March he will begin six weeks of work at the Phanatnikom refugee camp in Thailand. Sounds like a pretty varied year to me. . . . Still more congrats, these to **James Wolahan**, who obtained his P.E. license as a structural engineer in the State of Maine in July 1982.

**Meredith Warshaw** is now in her second year at the Bryn Mawr College Graduate School of Social Work. She writes, "I am spending three days per week doing field work in a hospice program working with dying patients and their families. I am also a graduate resident in an undergrad dorm. Unlike M.I.T., there is only one grad student per dorm. It's fun, but sure keeps me busy!" . . . My former freshman year associate advisor, Bob Resnick, '77, dropped me a line from Ann Arbor, Mich., where he is a second year M.B.A. student, to give me some dirt on '79ers with whom he has kept up (I tried not to end that sentence with a preposition, but it was a lost cause.) . . . **Ed Hunter** is still at Bolt Beranek and Newman, a software house located in the Boston area (and home for an awful lot of M.I.T. grads). Ed went to Florida last summer to watch the space shuttle launch, then to California for the landing. He managed to get a press pass for these events by claiming that he worked for the *Link* at M.I.T.! Ed is still active with LSC. . . . **John Shelton** works for Texas Instruments in Dallas. He was married last summer to Marilyn Strange, whom he met at the University of Texas. Congratulations, John! . . . At press time, **Don Glass** was finishing his Ph.D. thesis at M.I.T. and was planning to work for Amoco in Chicago. . . . Thanks, Bob, for the gossip!

**Amy Powell**, who lives across the street from me here in the Windy City, is in real estate with Prudential Insurance. Amy spent almost two years with Prudential in Boston, then moved here to Chicago in April 1981. She reports owning 28 different white blouses (the uniform at Prudential)!!! Amy also reports that **Bob Light** is back in Boston, teaching at the 'Tute in the Mechanical Engineering Department, and plans to be married soon. Bob, why don't you drop me a line to fill us in on all the details?

As for moi, at press time I am halfway through my six-month stint in Chicago, but by the time you read this, I will have left the harsh Chicago winter behind and will have re-established myself as a swinging Upper East Side single in New York, New York (great name for a song, don't you think?) I'm enjoying my stay here, working very hard, and keeping SPRINT in business single-handedly. Had dinner last week at the home of Jack Liebschutz, '74, and Nancy Lindsey, '74, whom many of you may remember as tutors in McCormick for many years. They're doing fine, have two children, and have lived here in Chicago since 1978. As for the rest of you, you are all clearly too busy doing wonderful and exciting things to write me—so why not sit down and write me about them? Happy 1983 to all, and remember—our 5th Reunion is only a year away! Bye for now.—**Sharon Lowenheim**, Secretary, 131 E. 83rd St., Apt. 2G, New York, NY 10028

# 81

Proving that sooner or later we all come back to Cambridge, **Jenny Devaud** wrote the following: "After graduating in June 1981, I moved to Colorado for a year and a half, working as an associate scientist with the Solar Energy Research Institute. Over this past summer, I worked for Bell at Murray Hill, N.J. and am now attending Harvard, planning on going for the big Ph.D. I liked Colorado better than Cambridge! Went skiing, hiking, snowshoeing, or cross-country every weekend, all year round! I'm getting quickly resettled though, and I have enjoyed re-establishing contact with old M.I.T. friends. I spoke with **Brenda King**, another '81 grad from materials science, who after spending several months in Mexico is now living in Weston and working at Lincoln Labs."

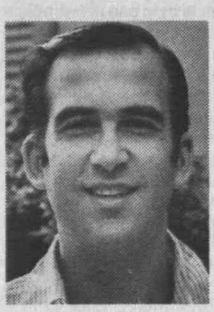
In the better-late-that-never department, **Barry Mirrer** writes: "I finally graduated (course VII-A) in June 1982. I also got engaged on the same day. (Congrats, Barry!) After taking the summer off to relax and drive to Los Angeles and back (stopping in Albuquerque to meet my future in-laws), I went to work at Bolt Beranek and Newman Computer in Cambridge."

As usual, I have learned this month that several of our classmates are attending medical schools. Per your many requests, I promise not to mention supper and first-year medical school studies in the same sentence—oops!) . . . **Mark Fogel** is currently "basking in the sunshine of Syracuse, N.Y." (not by the time this gets published!) "enjoying what free time I have and trying to fit in medical school besides. I have been coordinating various intramural sports leagues, as well as being on the orientation committee for next year's first-year students. I am also involved with a few Syracuse University and Upstate—College of Health Related Professions functions. I decided to also sneak in honors in gross anatomy and biochemistry, besides!" . . . **Jeffrey J. Schwartz** is currently a first year medical student at S.U.N.Y. Downstate Medical Center. . . . **Kathryn E. (Katy) Gropp** is in the Class of 1986, College of Veterinary Medicine, at the University of Florida. . . . **Abby Shevitz** wrote me a note when she was in town recently: "I've just finished spending my summer working and playing in Toronto. Now I'm going back to the University of Maryland School of Medicine, where I have had the dubious honor of having been elected president of my class, (as though med school wasn't time-consuming enough!)" Abby said that she hopes everybody she hasn't seen in a while might call or drop a line.

**Joel Timothy Garcia** completed his master's degree (mechanical engineering) in February 1982 and spent two months in Washington, D.C. on temporary duty following commissioning into the U.S. Navy. From April to October, Joel attended the navy's Nuclear Power School in Orlando. . . . Finally, I am pleased to announce that my good friend and past student government cohort, **Nick Adams**, (in a surprise move) was married this past Columbus Day weekend. Congratulations, Nick and Theresa! Keep those cards and letters comin'.—**Chuck Markham**, Secretary, 362 Commonwealth Ave., 2E, Boston, MA 02115

**Puzzle Corner**
**Allan J. Gottlieb**

# Happy Hunting in 1, 9, 8, and 3



*Allan J. Gottlieb, '67, is associate research professor at the Courant Institute of Mathematical Sciences of New York University; he studied mathematics at M.I.T. and Brandeis. Send problems, solutions, and comments to him at the Courant Institute, New York University, 251 Mercer St., New York, N.Y. 10012.*

This being the first issue of another new year, we offer another of our "yearly problems" in which you are to express small integers in terms of the digits of the new year (1, 9, 8, and 3) and the arithmetic operators. The problem is formally stated in the "Problems" section, and the solutions to 1982 are in the "Solutions" section.

In a recent letter, Phelps Meaker concludes, "Hoping that your son David enjoys puzzles as much as I do when *he* is 81 years old." So do I, Mr. Meaker—so do I.

Speed and chess problems remain in short supply.

## Problems

**Y1983** Form as many as possible of the integers from 1 to 100 using the digits 1, 9, 8, and 3 exactly once each and the operators $-$, $+$, $\cdot$ (multiply), / (divide), and exponentiation. We desire solutions containing the minimum number of operators, and solutions using the digits in the order 1, 9, 8, and 3 are preferred. Parentheses may be used for grouping, and they do not count as operators.

**JAN 1** Doug Van Patter has sent us a true-to-life bridge problem; this hand comes from a recent tournament in Lancaster, Pa.:

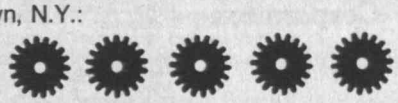
North (Dummy):
♠ 10 9 8 6 4
♥ A 5
♦ Q 8 6
♣ Q 10 4
South:
♠ A J
♥ Q J 8 6 3 2
♦ —
♣ A K 9 5 2

Four hearts was the popular contract. Usually ten tricks were taken. Only once or so in each section of the tournament (13 deals) were eleven tricks obtained. In this case the ♠2 was the opening lead, with East's ♠Q taken by the ♠A. Declarer played a second spade to West's ♠K. West shifted to the ♦A, ruffed by South. Now a trump was led to the ♥A; West played the ♥9, East the ♥4. When a second heart was played from the table, East played the ♥7 (trick 4). Any declarer who made eleven tricks found the best play at trick 5. What is East's heart holding? What is South's best play at this point? Assuming best defense, what are the precise odds that it would succeed?

**JAN 2** The M.I.T. mathematics majors have a map of Massachusetts on which they connected each town to its nearest neighbor (assume no ties). Show that no town is connected to more than five others.

**JAN 3** A geometry problem from Dean Edmonds: Consider a solid sphere and drill a hole (along a diameter) whose radius is such that the height of the remaining ring is two inches. Find the volume of the ring.

**JAN 4** Our last regular problem first appeared in the May 1942 issue of *Technology Review* as part of an advertisement from Calibron Products, Inc.; it was credited there to E. R. Morton of Brooklyn, N.Y.:



In building a model, a man found that he needed a 2:1 gear ratio. He had on hand only six equal gears (like those shown above), yet he was able to obtain the desired ratio, using full tooth conventional meshing. How?

## Speed Department

**SD 1** Smith Turner wants you to find the missing term:
6 2 5 5 4 ? 6 4 7 6 6 2 5 5 4 . . .

**SD 2** Doug Van Patter sent us a few bridge "quickies," and here is the first one from the collection:

North (Dummy):
♠ 10
♥ J 5 2
♦ K J 10 6 5
♣ 9 7 4 3
South:
♠ 8 3
♥ A K Q 7 4 3
♦ Q 2
♣ A Q 5

West leads the ♠K and then the ♠A. Is there a line of play that guarantees the contract of four hearts (assuming reasonable division of each suit and trumps distributed 3-1)?

## Solutions

**Y1982** The problem is stated above for 1983. For 1982, it appears generally agreed that 92 numbers are possible:

| | | | |
|---|---|---|---|
| $(1 + 9 - 8)/2 =$ | 1 | $(9 \times 8) - 21 =$ | 51 |
| $1 - 9 + 8 + 2 =$ | 2 | $81 - 29 =$ | 52 |
| $(1 \times 9) - 8 + 2 =$ | 3 | $9 \times (8 - 2) - 1 =$ | 53 |
| $1 + 9 - 8 + 2 =$ | 4 | $1 \times 9 \times (8 - 2) =$ | 54 |
| $9 + 8 - 12 =$ | 5 | $1 + 9 \times (8 - 2) =$ | 55 |
| $1 + 9 - (8/2) =$ | 6 | $1 - 9 + 8^2 =$ | 56 |
| $(8 \times 2) - (1 \times 9) =$ | 7 | $1 + 8 \times (9 - 2) =$ | 57 |
| $1 - 9 + (8 \times 2) =$ | 8 | $(8 - 1)^2 + 9 =$ | 58 |
| $19 - 8 - 2 =$ | 9 | | 59 |
| $(9 \times 2) - (1 \times 8) =$ | 10 | $(9 \times 8) - 12 =$ | 60 |
| $29 - 18 =$ | 11 | $9 \times (8 - 1) - 2 =$ | 61 |
| $(1 + 9) \times 2 - 8 =$ | 12 | $8 \times (9 - 1) - 2 =$ | 62 |
| $8 + (1 + 9)/2 =$ | 13 | $91 - 28 =$ | 63 |
| $9 + 8 - 2 - 1 =$ | 14 | $(9 - 1^8)^2 =$ | 64 |
| $(1 \times 9) + 8 - 2 =$ | 15 | $1^9 + 8^2 =$ | 65 |
| $1 + 9 + 8 - 2 =$ | 16 | $8 \times (9 - 1) + 2 =$ | 66 |
| $1^9 + (8 \times 2) =$ | 17 | | 67 |
| $1^2 + 9 + 8 =$ | 18 | $89 - 21 =$ | 68 |
| $9 + 8 + 2/1 =$ | 19 | $(9 \times 8) - 2 - 1 =$ | 69 |
| $1 + 9 + 8 + 2 =$ | 20 | $(9 \times 8) - 2^1 =$ | 70 |
| $29 - 8/1 =$ | 21 | $1 + (9 \times 8) - 2 =$ | 71 |
| $9 - 8 + 21 =$ | 22 | $82 - 1 - 9 =$ | 72 |
| $19 + 8/2 =$ | 23 | $(1 \times 82) - 9 =$ | 73 |
| $192/8 =$ | 24 | $1 - 9 + 82 =$ | 74 |
| $9/1 + (8 \times 2) =$ | 25 | $1 + (9 \times 8) + 2 =$ | 75 |
| $1 + 9 + (8 \times 2) =$ | 26 | $19 \times (8/2) =$ | 76 |
| $1 + (9 \times 2) + 8 =$ | 27 | $98 - 21 =$ | 77 |
| $29 - 1^8 =$ | 28 | $(1 + 9) \times 8 - 2 =$ | 78 |
| $19 + 8 + 2 =$ | 29 | $(1 + 8) \times 9 - 2 =$ | 79 |
| $29 + 1^8 =$ | 30 | $8 \times (9 + 2 - 1) =$ | 80 |
| | 31 | $82 - 1^9 =$ | 81 |
| $(8/2) \times (9 - 1) =$ | 32 | $1^9 \times 82 =$ | 82 |
| $(9 + 8) \times 2 - 1 =$ | 33 | $1^9 + 82 =$ | 83 |
| $1 \times (9 + 8) \times 2 =$ | 34 | $92 - 8^1 =$ | 84 |
| $1 + (9 + 8) \times 2 =$ | 35 | $92 - 8 + 1 =$ | 85 |
| $(1 + 9 + 8) \times 2 =$ | 36 | $98 - 12 =$ | 86 |
| $1 + (9 \times 8)/2 =$ | 37 | $89^1 - 2 =$ | 87 |
| $1 + 9 + 28 =$ | 38 | $89 + 1 - 2 =$ | 88 |
| | 39 | $89 \times (2 - 1) =$ | 89 |
| $(1 + 9) \times (8/2) =$ | 40 | $82 + 9 - 1 =$ | 90 |
| | 41 | $92 - 1^8 =$ | 91 |
| | 42 | $1^8 \times 92 =$ | 92 |
| | 43 | $1^8 + 92 =$ | 93 |
| $(89 - 1)/2 =$ | 44 | | 94 |
| $(89 + 1)/2 =$ | 45 | $98 - 1 - 2 =$ | 95 |
| $(19 \times 2) + 8 =$ | 46 | $(1 \times 98) - 2 =$ | 96 |
| $18 + 29 =$ | 47 | $1 + 98 - 2 =$ | 97 |
| $(98/2) - 1 =$ | 48 | $98 \times (2 - 1) =$ | 98 |
| $(98/2) \times 1 =$ | 49 | $198/2 =$ | 99 |
| $(98/2) + 1 =$ | 50 | $(1 + 9) \times (8 + 2) =$ | 100 |

Solutions were received from Chester Claff, Harry Zaremba, A. Holt, Allen Tracht, Samuel Levitin, Norman and Jesse Spencer, Robert Bart, Elaine Chow, John Rudy, Robert van der Heide, Donald Oliveau, Edwin McMillan, Jack Lissauer, Benjamin Rouben, Avi Ornstein, Peter Silvenberg, Randal Gressang, John Rollino, Steven and Arthur Silberberg, George Aronson, Alan Katzenstein, Jay Roth, Robert Thompson, Charles Rivers, Sidney Shapiro, Gerald Leibowitz, Chuck Coltharp, Phelps Meaker (who

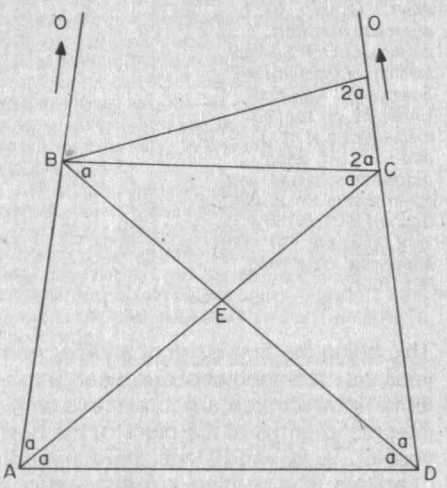
notes that more "in-order" solutions are possible if one permits "negative solutions," e.g. $-63 = 19 - 82$), and David DeWan, who writes, "As a newcomer to this problem, I was astounded by the variety of numbers that can be created with only four digits, five operators, and lots of time. I am once again in awe of the power of permutation. And genes are permutations of just four "digits" also: A, G, T, and C; no wonder there are lady bugs, redwoods, penguins, and porcupines."

**A/S 1** Place white bishops on a1 and a3 and place black bishops on e1 and e3. By moving each color alternately, such that a black bishop can never take a white one and conversely, and restricting moves to ranks 1 to 4 and files a to e (i.e., to ten black squares), exchange the position of the bishops so that the black bishops end up on a1 and a3 and the white bishops on e1 and e3.

Michael Jung and Matthew Fountain seem to have convincing evidence that no solution is possible. How about it, Mr. Chen?

**A/S 2** An isosceles triangle has a bisector of one of the two equal angles that is 6 inches long. If the base is 5 inches, without using trigonometry, find the length of the two equal sides.

The following solution is from Phelps Meaker:




The diagram represents the base section of a slender isosceles triangle AOD. The base is 5 units, the diagonals AC and BD 6 units; the diagonals bisect the base angles. Fold the triangle ABD about its side BD, so that AD lies along CD, extending 5 units to F, and side AB forms the member BF. Return triangle ABD to its original position, noting that triangles CBF and AOD are similar. Members AB, BC, BF, and CD are equal. Triangles BCD, BEC, and AED are isosceles and similar, providing three ratios as follows:

$BC/BD = BC/6$ (1)
$BE/BC = (BD - ED)/BC = (6 - AE)/BC$ (2)
$AE/AD = AE/5$ (3)

Combining (1) and (3):
$BC/6 = AE/5$; $AE = (5 \cdot BC)/6$
Combining (1) and (2):
$BC/6 = (6 - AE)/BC$; $\overline{BC}^2/6BC = (36 - 6AE)/6BC$
Combining the above:
$\overline{BC}^2 = 36 - 6(5 \cdot BC)/6$; $\overline{BC}^2 + 5 \cdot BC - 36 = 0$;
$BC = (-5 \pm \sqrt{25 + 4 \cdot 36})/2 = (-5 + 13)/2 = 4$.
$CD = BC$. Since $FD = 5$ and $CD = 4$, $FC = 1$.
In triangle CBF, the sides are four times as long as the base. Hence the side AO in the similar triangle AOD is four times AD; and the triangle given in the problem has sides of $5 \cdot 4 = 20$.

Also solved by Harry Zaremba, Mary Lindenberg, John Prussing, Everett Leroy, Steven Schmelling, David Evans, Matthew Fountain, Leon Bankorf, and the proposer, Emmet Duffy.

**A/S 3** Write the prime numbers and take successive absolute differences:

2 3 5 7 11 13 17 19 23 ...
1 2 2 4 2 4 2 4 ...

Note that the second row starts with a 1. Next repeat the process of taking successive absolute differ-

ences, obtaining

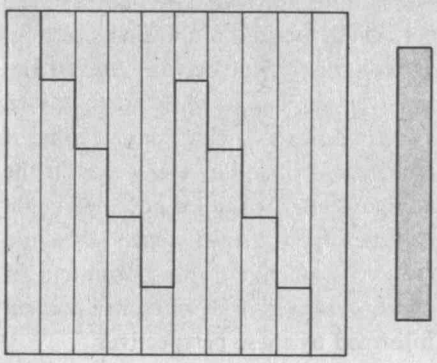
```
  2  3  5  7  11 13 17 19 23 29 ...
   1  2  2  4  2  4  2  4  6  ...
     1  0  2  2  2  2  2  2  ...
        1  2  0  0  0  0  0  ...
           1  2  0  0  0  0  ...
              1  2  0  0  0  ...
```

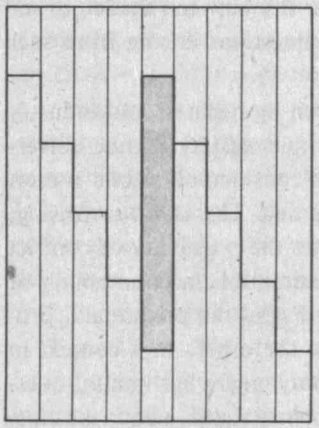
The problem is to prove or disprove that the series of leading 1's continues forever.

Matthew Fountain and Winslow Hartford submitted indications that the sequence of ones continues indefinitely. However, a proof is still wanting. Note that the difference between consecutive primes is not bounded (because the density of primes approaches zero).

**A/S 4** The "rug puzzle": you want to put wall-to-wall carpeting into a room that is 9 × 12 feet. You have two pieces of carpet, one 10 × 10 and the other 1 × 8. These do add to the correct square footage, but obviously the 10 × 10 must be cut. The challenge is to devise *one continuous* cut through the 10 × 10 piece such that the two resulting pieces will exactly fit the 9 × 12 area with one gap left over into which the 1 × 8 remnant can fit to complete the job.

The following solution is from Ken Haruta:





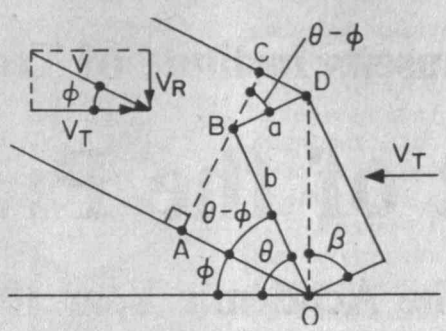
Also solved by Fuhsi Ling, Sidney Williams, David Evans, Matthew Fountain, Avi Ornstein, and the proposer, John Fogarty.

**A/S 5** One rainy day Fat Timothy was riding a donkey in the countryside ten miles away from the nearest shelter when he was caught in a strange rain which had a uniform mass density and fell straight down. Worried about being exposed to this strange precipitation, Timothy rode the faithful donkey as fast as he could to the nearest shelter. Assuming that the speed of the donkey was uniform and sufficiently high, find:

1. The amount of rain which fell on Timothy as a function of $\theta_T$, the angle Timothy's body makes with the ground.
2. The minimum and maximum amount of rain which might fall on Timothy.
3. The ideal situation in which Timothy would be wet least.

Approximate Timothy's body as a box.

The following solution is from Harry Zaremba:




In the drawing, assume the dimensions of Timothy's body are a, b, and c where c is perpendicular to the page and $a < c < b$. Also assume that the donkey's velocity $V_t$ is such that the rain falls on the top and front of Timothy. If $V_r$ is the rain's rate of fall, then the relative velocity of the rain with respect to Timothy is $V = (V_r^2 + V_t^2)^{\frac{1}{2}}$, and $\phi = \tan^{-1}(V_r/V_t)$.

The area of rainfall that will be intercepted by Timothy's body is $A = c(AB + BC) = c[a\cos(\theta - \phi) + b\sin(\theta - \phi)]$, and the time required to reach the shelter is $T = D/V_t$, where D = 10 miles, the distance to the shelter. In time T, the amount of rain that will fall on the rider is $R = AVT = c[a\cos(\theta - \phi) + b\sin(\theta - \phi)] \sqrt{V_r^2 + V_t^2} \cdot D/V_t$.

Noting that $\cos\phi = V_t/\sqrt{V_r^2 + V_t^2}$, the total amount of rain on the rider becomes

$$R = [a\cos(\theta - \phi) + b\sin(\theta - \phi)] \cdot Dc/\cos\phi. \quad (1)$$

The minimum amount of rain that can fall on Timothy occurs when his topside surface is perpendicular to the apparent path of the rain. In this event, $\theta = \phi$, and the amount of rain from equation (1) becomes $R_{min} = Dca/\cos\phi$.

For maximum amount of rain, the riding position must be such that the diagonal OD of Timothy's body is perpendicular to the relative velocity V of the rain. Under this condition, the projected area of Timothy's body on a plane perpendicular to the rain's apparent path is $A = c\sqrt{a^2 + b^2}$. Thus, the maximum amount of rain is $R_{max} = \sqrt{a^2 + b^2} \cdot Dc/\cos\phi$.

The ideal situation for getting wet the least is to ride at an angle where $\theta = \phi$ and where the smallest area of the body is exposed to the rain. In the current case, the smallest area equals ac, the topside area of Timothy. When equation (1) is expanded, divided by $\cos\phi$, and simplified, the result is $R = Dc[a\cos\theta + b\sin\theta + (a\sin\theta - b\cos\theta)\tan\phi]$. It is noted that the term with factor $\tan\phi$ will be eliminated when the factor $(a\sin\theta - b\cos\theta) = 0$, or $\tan\theta = b/a$. The interesting things about this is that, when the rider's body makes an angle of $\theta = \tan^{-1}b/a$ with the ground, the amount of rain to fall on the rider remains constant, irrespective of the velocity $V_t$ of the donkey. This holds true as long as $V_t \neq 0$. The amount of rain that will fall on the rider is $R = Dc(a\cos\theta + b\sin\theta)$.

Also solved by Matthew Fountain, M. Pope, and Minn Chung, editor of the Physics Department newsletter from which the problem was originally taken.

**Better Late Than Never**

**JAN 2** Henry Fisher has responded.

**JUL 3** H. Spacil has sent photos showing that clocks in Asia are displayed at 10:09.

**Proposers' Solutions to Speed Problems**

**SD 1** 5. Each term is the number of lit elements when a calculator displays the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, 1, 2, 3, 4, . . .

**SD 2** Do not ruff the second spade but discard a club from dummy. Now West cannot force declarer. Take out two rounds of trumps, then knock out the ♦A. The ♥J takes the third trump and provides an entry to dummy's clubs.

# Massachusetts Institute of Technology

# Report of the President

## For the Academic Year 1981-82

The Institute's principal mission is centered on the generation of knowledge, and on its preservation and transmission to new generations of students. During the past year, there has been broad concern about a number of issues which remind us, once again, of the power of knowledge, and of the fact that knowledge is power. The questions of how closely knowledge is held, how freely it is shared, and with whom, have permeated most of the major events and issues of this academic year — linking together several domains which, at first glance, may not appear to have much in common.

These issues include: first, changing patterns in the organization and support of research; second, questions relating to the international transfer of technology; and third, access to higher education. They illustrate the ways in which the generation, dissemination, and control of knowledge influence the intellectual and organizational development of MIT.

### The Generation of Knowledge: Changing Patterns of Research Organization and Support

During the past several years, there has been a steady increase in the scale of industrial support of sponsored research in universities. While, on a relative basis, the scale of such support is still small, it is growing rapidly. At MIT, for example, industrial support of such research has grown from $6.7 million in the 1977-78 academic year to $19.7 million in this past year, and now constitutes about a tenth of the sponsored research conducted on the MIT campus.

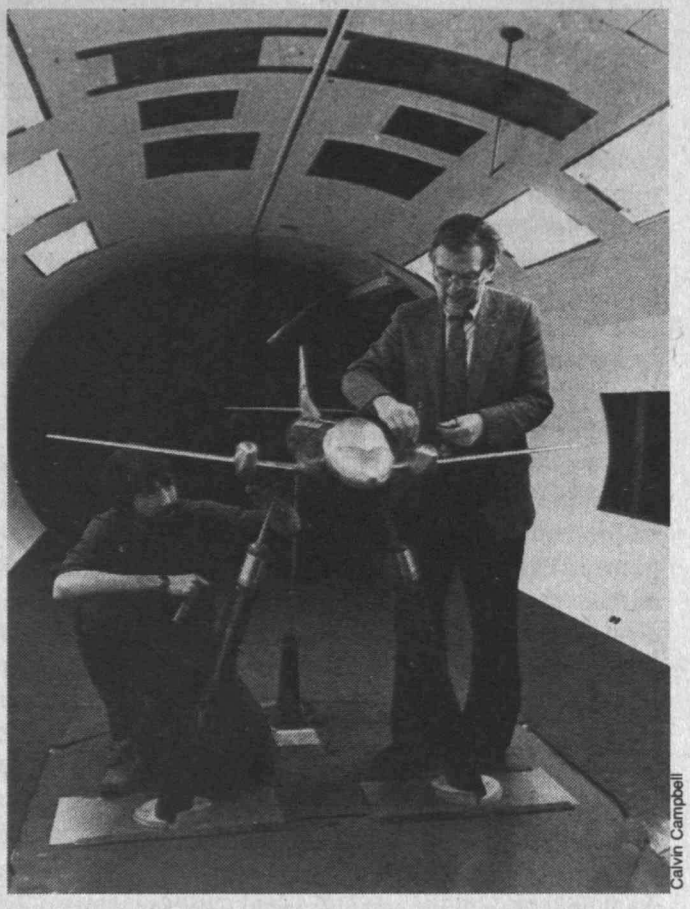
For some, the growth in industrial research sponsorship raises almost as many questions as opportunities, and has led to debate within the academic community on how best to ensure the transfer of new ideas and technology from the laboratory to the wider society.

The opportunities generated by industry's increasing support of research are manifold. They include the prospect of stable, long-term funding which may complement government support of basic research, which has declined in real terms in recent years. In addition, and importantly, both universities and industry can benefit from closer communication and ties. After all, both rely, for their own evolution and growth, on the talent and new ideas generated by a vigorous system of higher education. Further, new ideas and technologies which are born in an academic setting must be nurtured and developed before they lead to broad practical uses. This development usually occurs in a business setting, and is aided by effective communication between universities and business. Finally, universities can better chart their own future development in certain areas, such as engineering, if they know about the changing directions and needs in the world of business and industry. This does not mean that universities will forsake their traditional independence and reliance on their faculties to pursue shifting frontiers of knowledge. It does mean, however, that our development can, and should, be informed by these perspectives.

At the same time that we recognize the opportunities and mutual advantages of closer ties between academia and industry, we must consider the questions arising from such association.

The sponsorship of research by business and industry has, at times, created considerable anxiety within universities, and has been the subject of considerable public interest and commentary in the media as well. This is not surprising, because such collaboration carries the possibility of conflict between the essential openness and public accountability of the universities, on the one hand, and the private and proprietary interests of industry on the other. In a context in which knowledge becomes not only power but wealth, questions arise about intellectual property rights, about the closing down of communications between research colleagues, and about the effect of varying degrees of openness or secrecy on the progress and integrity of research. For some, industrially sponsored research appears to increase the probability that universities will be compromised in their independence and objectivity, or that their priorities and activities will be distorted by private influence.

These kinds of questions led to a gathering last March of people from five major research universities (the California Institute of Technology, Harvard University, MIT, Stanford University, and the University of California) at Pajaro Dunes, California, to explore the issues generated by commercial sponsorship of research and other forms of interaction between industry and academe. The meeting was



Calvin Campbell

enhanced by the participation of a number of representatives from industry — and from the new biotechnology firms in particular. Our purpose was not to generate rules — we held no charter, indeed no unique interest, which would justify rule making. Rather, it was to try to frame the important questions and to agree, where we could, on some general principles which might be worthy of further consideration by our own institutions and by others not represented at the conference. While the meeting was prompted by issues associated with the commercialization of biotechnology, it was by no means limited to that sphere of activity.

At the end of two days of intensive discussion, we issued a statement to summarize the results. The following excerpts from that statement speak to the principal issues which arise, and the essential conditions which must be satisfied, in the context of industrially sponsored research.

*... It is important that universities and industries maintain basic academic values in their research agreements. Agreements should be constructed, for example, in ways that do not promote a secrecy that will harm the progress of science, impair the education of students, interfere with the choice by faculty members of the scientific questions or lines of inquiry they pursue, or divert the energies of faculty members from their primary obligations to teaching and research.*

*Universities have a responsibility to maintain these values but also to satisfy faculty, students, and the general public that they are being maintained ....*

*The traditions of open research and prompt transmission of research results should govern all university research, including research sponsored by industry. Those traditions require that universities encourage open communication about research in progress and research results. However ... it is appropriate for institutions to file for patent coverage for inventions and discoveries that result from university research. This action may require brief delays in publication or other public disclosure.*

*Receipt of proprietary information from a sponsor may occasionally be desirable to facilitate the research. Such situations must be handled on a case-by-case basis in a manner which neither violates the principles stated above nor interferes with the educational process. Any other restrictions on control of information disclosure by institutions are not appropriate as general policy.*

Experience at MIT and elsewhere suggests that contractual arrangements can be developed which will permit the private sponsorship of research in the university on terms which satisfy both the corporate need for competitive advantage **and** which preserve the essential openness and independence of the university. I believe that such arrangements, properly constructed, are advantageous to both parties to the agreement **and to the larger society** and I am hopeful that the scope and frequency of these arrangements will continue to expand.

* * *

The remarkable developments in the life sciences, which have spawned much of the increased interest by industry in sponsoring university research, have influenced the development of new organizations within and between research institutions as well. One such development occurred this past year with our decision to approve an affiliation with MIT of the Whitehead Institute for Biomedical Research, a new not-for-profit research institute in the life sciences. That institute, which has been established by Edwin C. Whitehead, the founder of the Technicon Corporation, a major medical instrumentation company, will focus its research efforts on basic questions in developmental biology.*

The organizational, financial, and intellectual associations between MIT and the Whitehead Institute are complex, and define an entirely new way for institutions to interact and complement each other.

The affiliation of the Whitehead Institute with MIT was first proposed by Dr. David Baltimore, who is the first director of that institution and is the American Cancer Society Professor of Microbiology at MIT. The affiliation reflects his conviction that the quality and effectiveness of

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**Mr. Whitehead has provided a source of assured funding for the operation of the Whitehead Institute; is providing the funds for a new physical facility in the Kendall Square Redevelopment Area adjacent to MIT, the construction of which will begin this fall; and has made a commitment to provide an endowment on the order of $100 million for the long-term support of the Whitehead Institute.*

research at the nascent Whitehead Institute would be strengthened if a way could be found to involve scientists there in teaching and in the intellectual life of a university. The intermingling of teaching and research, in a way in which each reinforces the other, is the central source of strength of the US research universities. It has long characterized MIT's activities, and it is the underlying motivation for this arrangement with the Whitehead Institute.

The primary relationship between MIT and the Whitehead Institute will be through the appointment, over time, of some 12 to 14 research scientists who will hold joint positions on the MIT faculty and on the senior research staff of the Whitehead Institute. As MIT faculty, they will be selected in accordance with the usual MIT faculty selection processes, and will have all the rights and responsibilities of faculty members at MIT, including supervision of graduate students. Their research facilities and their salaries will be provided by the Whitehead Institute. Graduate student enrollments will expand in proportion, and these additional students will be supported by the Whitehead Institute.

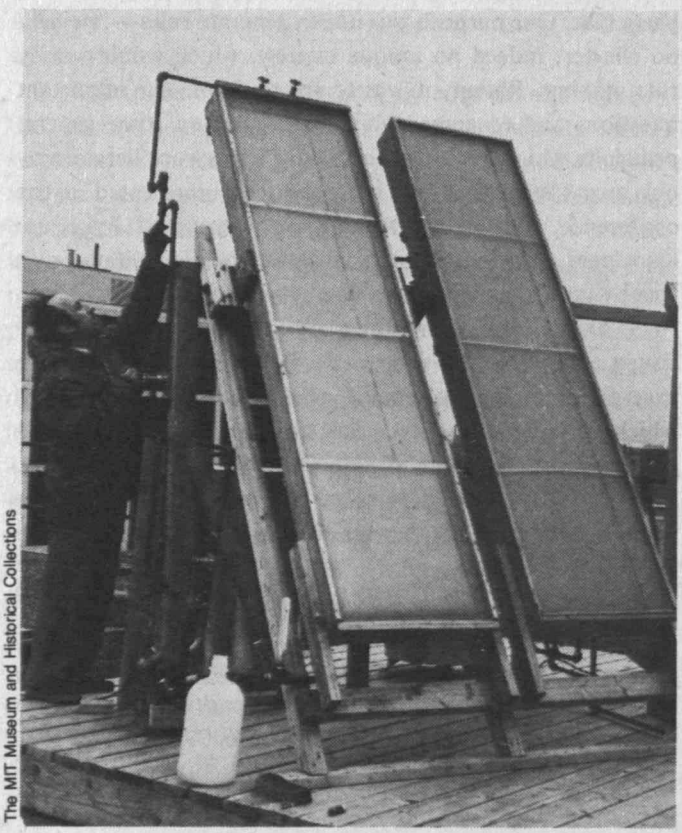
To my mind, the important questions about the Whitehead affiliation have to do with the possible effects it may have on the academic community in the life sciences at MIT. During the year, discussions concerning the proposed affiliation revolved around ways in which such an affiliation could enhance, or disrupt, the intellectual and institutional life of this place. The deliberations of the Corporation about these issues benefited greatly from the debates undertaken by the faculty.

Such a large addition to the life sciences effort at MIT does present certain risks as well as clear opportunities. The principal risk has to do with the fact that as many as one-quarter of the members of the Biology Department faculty will have a dual loyalty, leading to a concern that this dual loyalty could evolve toward a divided allegiance. Will those faculty who have joint appointments function in ways which reflect the values and traditions of their colleagues in the life sciences at MIT? Or will they, acting in response to different interests and divergent forces, comprise an alien block which will come into conflict with the scholarly community which now exists here in the life sciences?

My own view — which I believe reflects that of a majority of our faculty — is that the relationships of the joint faculty to MIT are likely to be collegial and congenial, and that their sharing of loyalties with this particular organization will **not** conflict with, or weaken, the life sciences here. Nor does it seem likely that such relationships will produce activities inappropriate to this academic community. Rather, I believe that the affiliation will enlarge and strengthen teaching and research in the life sciences at MIT and, indeed, will benefit the larger life sciences research community in the Boston area. In brief, we will all gain from the significant expansion in the community of scholars in this field; from the existence of new facilities; a larger community of graduate students, postdoctoral fellows, and faculty; new intellectual resources for instruction, including undergraduate instruction; and expanded opportunities for undergraduate participation in research.

These benefits to MIT would be of considerable importance at any point in the history of this university. They are particularly significant today. For as we develop these expanded opportunities in the life sciences, we can anticipate no growth, and even some reduction, in the traditional forms of support for research and education, not only for those fields but for academic institutions in general.

The MIT-Whitehead relationship represents an exciting organizational innovation. But MIT is not a stranger to inventing new ways to support intellectual and educational objectives. Even a cursory review of our history reveals a myriad of new organizational arrangements: the postwar development of large-scale sponsored research arrangements with the Federal government — arrangements which raised questions of independence and control of research directions; the establishment and continued operation of the Lincoln Laboratory; the development of interdepartmental research laboratories, beginning with the Research Laboratory of Electronics; the formation and growth of the Industrial Liaison Program; the joint degree programs with the Woods Hole Oceanographic Institution; and a variety of joint programs with Harvard University and with Wellesley



The MIT Museum and Historical Collections

College, to cite a few. While the affiliation with the Whitehead Institute is novel, it is, I believe, consonant with our central purposes and with our tradition of responding to new opportunities with new arrangements when that seems desirable.

* * *

Indeed, while I have reported on its development on other occasions, this section of this report would not be complete without mention of the dedication this past spring of yet another new institutional form at MIT — the Whitaker College of Health Sciences, Technology, and Management — which provides a focus for many of the health-related research and teaching programs of the Institute, including such emerging fields as biomedical engineering and biological physics. Because the teaching and research programs brought together and advanced by this new institutional structure far transcend the concerns of any single department or School at MIT, the term "College" was used for the first time in the history of the Institute.

Through Whitaker College, MIT is now able to extend the opportunities available to, and provide a focus for, faculty members and students throughout the Institute who wish to participate in health-related education and research. Thus the College's educational program provides for the integration of teaching and clinical programs which involve faculty and students from many areas of specialization and which address major human health and medical problems. This involves joining the efforts of physicians, biologists, physical scientists, engineers, psychologists, management experts, and others.

The College incorporates, in addition, the MIT components of the Harvard-MIT Division of Health Sciences and Technology. One of the several collaborative programs with Harvard mentioned earlier, the Division is part of a continuing joint venture of Harvard and MIT to apply the complementary strengths of both universities to the development of new kinds of physicians and other health professionals and to the application of modern science and technology to health and medical problems. The Whitaker College exemplifies superbly the freedom with which educational institutions have always invented new institutional arrangements — in this case, one that provides an especially rich environment for the advancement of the whole domain of biotechnology.

The creation at MIT of Whitaker College, both as an organization and as a splendid new facility, reflects the creative philanthropy of Mrs. Helen F. Whitaker, Life Member Emerita of the MIT Corporation, and her late husband, U.A. Whitaker. Their interest in the life sciences, in the application of science and engineering to health care and to living systems, and in education in health-related fields, has enabled the Institute to make great progress in these important areas.

## Dissemination and Control of Knowledge

Over a period of years, we have seen concerns develop within the Federal administration about the dissemination outside the US of the results of research developments achieved in this country. These concerns derive partially from a conviction that the Soviet Union has become very effective in sifting the US scientific and technical endeavor to obtain and employ information to the military and strategic advantage of the USSR. The concerns derive, too, from the increasing competition in world markets for high-technology products — a competition exemplified by both Japan and nations in Western Europe.

As a consequence, the concept of export control regulations has been extended beyond materials and devices to include the international traffic in ideas. In this, the international arena, the Federal government clearly recognizes the power of knowledge and the fact that the nation's economic health and stature in international affairs depend greatly on our technological and scientific leadership. There is, I believe, far less understanding of the degree to which quality and continued progress in these areas depend on openness and on sharing of information within the research community, and of the role of open communication and access to research developments in the educational enterprise.

Throughout the year, there has been much discussion of the issues and problems relating to "technology transfer" — discussion within MIT, within the broader research and academic communities, within government, and among all these constituencies. As this report goes to press, some of these deliberations are reaching conclusion. My remarks here are not intended to forecast these conclusions nor to circumscribe full discussion of these issues at MIT but, rather, to contribute to that discussion some comments of my own on the nature of academic research.

To begin, the research universities in this country are international communities of students, faculty, and research staff who are selected on the basis of ability and promise — a basis which gives little regard to national origin. Within the universities, research proceeds in an open environment where the exchange of information and ideas is a communal activity, engaged in by all. In fact, the copious informal communication among researchers — be they faculty members, students, or staff — is probably more important than the formal communication that accompanies publication at the end of the process. The journals become the journals of record, but the important communication about ongoing work occurs in a myriad of conversations — at meetings, in the laboratory and at lunch, over the telephone, via the computer terminal, and in all the other ways the best people in any field of research are in touch with each other, ways that never enter the formal system of reviewed publication for the record. The whole research process depends very heavily on

feedback and on error correction through this wide, informal exposure of results to peers.

Sissela Bok published a paper last winter in the journal *Science, Technology and Human Values* called "Secrecy and Openness in Science: Ethical Considerations." In it, she spoke most tellingly to the connections among openness, integrity, and quality in research:

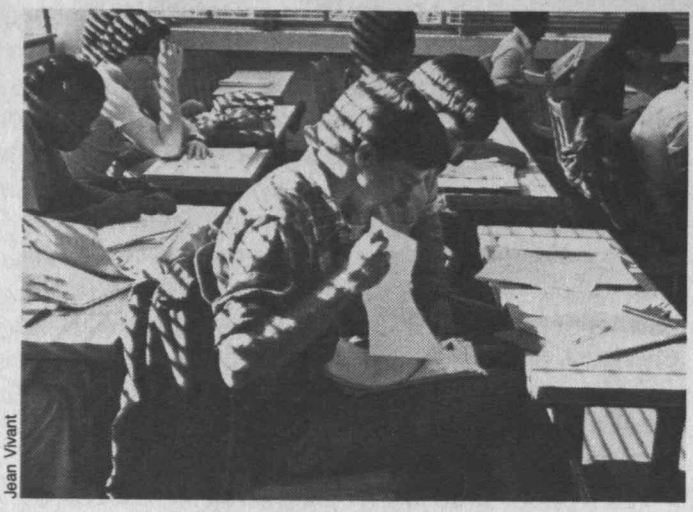
*The felt need to take a stand against secrecy also springs from concern for what is most central to the scientific enterprise itself: from a recognition of the damage that secrecy can do to thinking, to creativity, and thus to every form of scientific inquiry. Because secrecy limits feedback and restricts the flow of knowledge, it hampers the scientists' capacity to correct estimates according to new information, to see connections, to take unexpected leaps of thought. And secrecy is expensive in that it fosters needless duplication of efforts, postpones the discovery of errors, and leaves the mediocre without criticism and peer review. Secrecy, therefore, can cut into the quality of research and slow scientific momentum.*

Any proposals to classify sensitive research projects, or to restrict either publication or the nationality of researchers for certain projects, must be carefully weighed against resulting cost to the research process, to its progress, and to its quality. This country's scientific and technological leadership has its roots in the universities, whose strengths are based on open and shared exploration of ideas in education and research. A departure from this principle in certain fields would mean that many institutions would be unwilling to work in those areas, leading to a loss of effort and, most critically, a loss of trained young people in just those fields the government is trying to safeguard.

Certain of these fields are also closely coupled to educational issues. Take the area of very large-scale integrated electronic systems as an example — one in which the Institute is presently moving toward a major new program and facility. The future of education in electrical engineering and computer science is entirely bound up with the whole issue of integrated systems. In the future, these systems will be the hardware in which electrical engineering and computer design is done, and will form the basis for the curriculum. If universities are constrained from doing research in that area because of restrictions associated with export control, then inevitably the quality of our education in those areas will suffer as well. In the long run, this will do great damage, not only to the universities, but also to the society which depends on them for high-quality educational programs in that area.

## Keys to Knowledge: Access to Universities and Higher Education

We have long held that universities have an obligation to educate the brightest and most promising students in the society, in order to tap and to nurture the full range of talent for the benefit of all. As long as the powers of knowledge,



Jean Vivant

and particularly opportunities in science and engineering, are closed to individuals in certain segments of the population, our universities are not fulfilling their mission and the society is less than whole. Particularly troublesome this year has been the shift in student financial aid policies and the funding cuts proposed by the Federal administration and their probable impacts on equality of educational opportunity in our country. Beyond financial concerns, there are other factors affecting students' access to and progress in academic institutions — problems which we must address at MIT.

The Federal posture with respect to financial aid for students has undertaken a discontinuous change in the past two years. Following a quarter century of increased Federal financial aid for students, there has occurred a sharp change in the other direction. In the 1982 Federal budget, the administration proposed and the Congress enacted a number of serious changes which reduced funding for student aid programs.

This year, the administration recommended further cuts for the years ahead. The proposals for fiscal year 1983 included very large reductions in the funding and eligibility for the major grants and loan programs, including a proposal to eliminate all Federally guaranteed loans to graduate students. While the Congress did moderate the impact of these proposals, severe reductions in the funding of student aid programs remain in place as features of the administration's budget proposals for 1984 and 1985.

What do these signals portend for the state of higher education? We could find ourselves with a system of higher education in which most students have little choice in schools, a system in which the highly selective, private universities are out of the reach of all but a very few. In such a system, the quality of private, undergraduate colleges would inevitably decline as the force of economics pulls many well-qualified students away, and many privately supported colleges would face crushing economic pressures as enrollments decline.

If this trend is not stopped, many bright, low-income high school students will lower their eyes from distant and

promising horizons. Many college students will become discouraged from going on to graduate school, and many who are now in the midst of their studies — graduate and undergraduate — will drop out for financial reasons. Enrollments will shift toward those who can pay their own way. And inevitably, social and economic diversity among college and university students will narrow as educational opportunity becomes tied more closely to economic status. In the long run, the quality of our educational institutions and of our society will suffer. Indeed, I believe that quality is already endangered.

The impact of this abrupt policy change in Federal support of student aid is compounded by the rate at which the costs of higher education are rising. The MIT tuition for the coming year has been set at $8,700, three times the amount for tuition a decade ago. And while the ratio of tuition to starting salary upon graduation has remained essentially constant over the years, the prospect of investing such a large amount and incurring large debts can be overwhelming to many high school students and their families.

Next year we will expect each needy undergraduate student to meet the first $4,000 of his or her need through self-help — that is, by some combination of loans and term-time jobs. Given the state of the economy and the Federal posture on student aid, one can well ask whether we are approaching the limit to what we can reasonably expect in terms of self-help.

Even when we ask every needy student to come up with $4,000 before we award grants or scholarships, the call on our general funds to support our scholarship programs keeps growing. Until 1979, we seldom spent $1 million a year from general funds to supplement our endowed resources for scholarships. This year, 1982, we spent $2.6 million. With the 1982-83 tuition and self-help level, we will be spending nearly $4 million in general funds to supplement endowed scholarship resources. That number is increasing very rapidly because, as Federal funds decrease, there are more calls on the Institute's general funds to supplement our aid programs.

These changes raise a number of issues for us to consider, including the questions of who has access to an MIT education and how to maintain the economic viabiliy of the Institute. I believe we must review our financial aid policies and our strategies for meeting those policies. In so doing, we must give particular attention to the question of access for minorities and for applicants who cannot afford the full price of an MIT education.

I would suggest that one particular area of study concerns sources of loan support. Fifty years ago, the Technology Loan Fund was created by alumni of the Institute in the face of a national crisis which had some similar dimensions. It made an enormous difference to MIT in the 1930s, and it seems to be time again to call on the graduates of the Institute to increase the flow of funds to MIT for loans to students in support of their educational programs.

There are other factors affecting access to and progress in MIT's educational program. I think we must face squarely and improve our record for attracting and retaining women and minorities on the faculty. We need to do better — all of us on the faculty and staff — in attracting outstanding scholars to the Institute, and in nurturing their professional growth once they are here. One way of doing this would be to invite some outstanding minority or women scholars from outside MIT to serve as ambassadors-at-large, to visit the campus periodically, and to assist us in the identification and recruitment of individuals for faculty openings. The appointment of more minorities and women to the department visiting committees will also help to open this faculty to the richness and diversity of talent it deserves. I am pleased that we have made some progress in this latter area during the past year.

Another step was taken at the close of the academic year when the Institute was host for the first national Conference on Issues Facing Black Administrators at Predominantly White Colleges and Universities. This conference, which brought together more than 500 persons from colleges and universities all over the country, provided a forum for exploration and discussion of the issues which face minority staff members in those institutions where they were an invisible (or absent) minority until a decade ago. The conference was planned and implemented by the Association of Black Administrators at MIT, under the leadership of Dr. John B. Turner, Associate Dean of the Graduate School, and Dr. Clarence G. Williams, Special Assistant to the President. This conference was enthusiastically received and clearly met a strong need, and it helped to identify a practical agenda for the future.

The keys to knowledge are of transcendent importance to this society and they must be accessible to all of us. The struggle to make equal opportunity an American reality — not just an American dream — is even more important in these times, for the Institute as well as for the society of which we are a part.

## Undergraduate Education

In this report a year ago I described an intensive and wide-ranging review of issues affecting undergraduate education at MIT — a review undertaken by the Committee on Educational Policy under the leadership of the then-Chairman of the Faculty, Professor Sheila E. Widnall. That review has continued under Professor Felix M. Villars, present Faculty Chairman. Some comments on progress made during the year are in order.

During the year the CEP recommended, and following extended discussion, the faculty adopted a General Institute Requirement in Writing. This action reflects a widely shared conviction that many MIT students do not write well enough, either for their studies at MIT or for their professional careers later on; that the curriculum as a whole should value

and foster good writing; and that the Institute and its students would benefit from greater attention to this problem. The success of this requirement will depend on the acceptance of a shared, curriculum-wide responsibility to emphasize the importance of writing in all subject areas and to provide opportunities for students to develop their writing skills.

The CEP reviews of the science requirements and of the Requirement in the Humanities, Arts, and Social Sciences continue. These reviews have raised several fundamental questions: What are the primary purposes of the Institute science requirements, and what role do they play for students whose majors are not in science or engineering? How do these requirements affect the diversity of the undergraduate student body? Should there be additions to the core science requirements? How would such additions affect an individual's academic explorations, the pace of MIT, and existing departmental programs? What are the fundamental objectives of the Humanities, Arts, and Social Sciences Requirement within the MIT educational experience? How can this requirement be structured to reflect both appropriate balance among these elements, and reasonable parity with the science requirements?

These and other questions concerning the quality, pace, and pressure of education at MIT are under continued study by the CEP, which expects to make recommendations to the faculty concerning the General Institute Requirements during the coming year.

## Institute Finances and Planning

Following five years of precarious balance in the financial operations of the Institute, the budget slipped into deficit in 1981-82. Specifically, we recorded a deficit of $2 million on total operating expenses of $515 million. While the deficit may be small as a fraction of the budget, it is significant and troublesome because it requires the expenditure of capital — of unrestricted funds functioning as endowment. Thus, future earnings are lost forever, and future budgets are made a bit more difficult to balance.

In an operation as large and as complex as the Institute, it is difficult and somewhat artificial to associate a deficit of this size with any particular causes. Nevertheless, the principal forces causing expenses to grow faster than income seem to be the following:

- The residual impact of several years of double-digit inflation
- Necessary efforts to achieve more competitive levels of faculty salaries, particularly at the level of assistant professor and primarily in the Schools of Engineering and Management
- The continued shift of undergraduate interest toward majors in engineering — now more than two-thirds of all undergraduates who have declared a major are enrolled in the School of Engineering, almost double what it was a decade ago. The increases in enrollment have fallen primarily to Chemical Engineering, Electrical Engineering and Computer Science, and Mechanical Engineering, and have required the allocation of new resources to the School to meet the enrollment pressures — resources which cannot, in the short run, be offset by budget reductions in areas where enrollments have declined.
- The cost of operating and maintaining new facilities for which endowed maintenance funds fell short of the desired budget.
- Support for important new programs, such as those in plasma fusion and in health sciences and technology.
- Reductions in the portion of indirect costs paid by research sponsors — reductions caused by the decline of expenditures for research relative to the expenditures for education.

We have now embarked on a review of **all** programs and activities, with the dual objectives of, first, examining the role and function of each activity and charting its future development in the context of broad, long-range directions for the Institute, and, second, of reducing operating expenses by an amount sufficient both to balance the operating budget and to reduce our reliance on annual unrestricted gifts, grants, and bequests, so these precious resources can be used for capital purposes such as building the Institute's endowment. This is a demanding and difficult task, following, as it does, more than a decade of financial stringency. The necessary reduction of expenses and of employment levels will be painful.

I believe that these efforts to reduce and adjust the Institute's operating budget will be most effective and long lasting if they are a part and a consequence of a conscious long-range planning effort — one which clarifies the mission and points directions for the future development of our manifold activities. Planning in the academic setting is still an immature and developing art. How do we appraise the future potential of complex and diverse activities — activities

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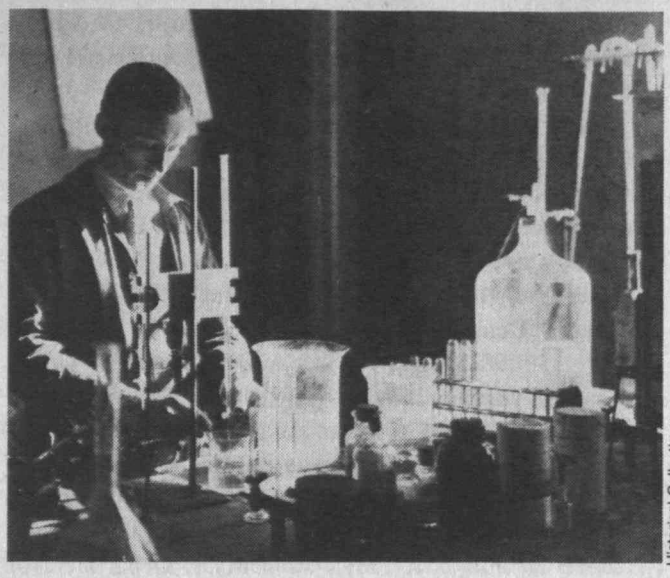


Historical Collections

which offer no simple measure of effectiveness, impact, or centrality? How do we make informed and rational judgments about resource allocations among these diverse activities?

Planning efforts are now under way in both the academic and support services domains. These efforts will inform budget making for both the 1983-84 and 1984-85 academic years and will help the necessary transition to balanced budgets in future years.

## In Special Recognition

From time to time, there are occasions which remind us of the special accomplishments which individuals contribute to the life of an institution. In March, after 15 years as Dean of the School of Science, Robert A. Alberty returned to the ranks of the faculty as Professor of Chemistry. During his tenure as Dean, the School grew both in quality and in the intellectual domains it encompasses. His care for the well-being of the School was demonstrated not only by his attention to research interests and faculty development, but by a deep concern for the quality of the basic undergraduate program, and we are deeply grateful for his contributions to the School and to the Institute as a whole.

Professor Alberty's retirement as fourth Dean of the School coincided with the 50th anniversary of the School of Science, which was established in March 1932 upon the recommendation of then-President Karl T. Compton. Also established formally at that time were the Schools of Engineering and Architecture, as well as the Graduate School, a Division of Humanities, and a Division of Industrial Cooperation. The programs in Engineering and Architecture had been well established, of course, and MIT was generally regarded as a first-rate engineering school. In that context, the establishment of a School of Science represented a milestone in the development of the Institute.

Karl Compton had come to MIT as President in 1930 and soon infused the institution with new ideas and a new spirit, despite the flagging enrollments and economic constraints brought about by the Depression. A noted experimental physicist, Compton had a tremendous influence on the development of basic science at MIT. He foresaw great developments in scientific fields in the future and felt that MIT should be in the vanguard of these advances. Moreover, he believed that if engineering education were to prosper, it would have to be built on a solid foundation in physics, chemistry, and mathematics, and that these fields should be studied in their own right. In order to reach these goals, he set about to develop faculty, promote research, and establish graduate studies.

The School and the Institute have prospered from his vision that the Institute, "to perform its greatest service, must take the lead in actually developing science and its applications as well as in technological instruction." From those early formal beginnings has grown a School of enormous stature, which continues to evolve as its faculty meet and define new intellectual frontiers — exploring the far reaches of space, the nature of subatomic particles, the forces underlying continental shifts, the genetic codes governing life itself. The research endeavors of the eight departments and their associated research centers contribute much to the quality of education at both the undergraduate and graduate levels. And while no longer the simple "service" departments they were in the days before the School was established, the Departments of Chemistry, Mathematics, and Physics remain at the heart of the academic program for every undergraduate. This insistence on science helps to define an education of extraordinary power, regardless of a student's major field of study, and its spirit infuses the academic enterprise throughout the Institute today.

The special character of MIT is also seen each year in the achievements and honors of its faculty. While it is not possible to take note of every such distinction, there are some highlights which deserve mention.

The National Academy of Engineering welcomed several more MIT members to its ranks this past year: Professors Peter S. Eagleson of the Department of Civil Engineering, Kent F. Hansen of the Department of Nuclear Engineering, James R. Melcher of the Department of Electrical Engineering and Computer Science, Julian Szekely of the Department of Materials Science and Engineering, and Dr. Bernard Gold of Lincoln Laboratory.

In April, four members of the MIT faculty were elected to the National Academy of Sciences. They are: Professors Robert W. Balluffi of the Department of Materials Science and Engineering, Robert W. Mann of the Department of Mechanical Engineering, Phillips W. Robbins of the Department of Biology, and Gian-Carlo Rota of the Department of Mathematics. Also during the winter, Institute Professor and former Provost Walter A. Rosenblith was elected Foreign Secretary of the Academy.

The American Academy of Arts and Sciences elected Professor Henry W. Kendall of the Department of Physics

and Professor James Wei, Head of the Department of Chemical Engineering, as members during the past year; and elected Professor Herman Feshbach, Head of the Department of Physics, as president of that organization.

Three members of the MIT community were surprise recipients of MacArthur Prizes during this academic year. The MacArthur Prize Fellows Program was established by the John D. and Catherine MacArthur Foundation to recognize and give certain talented individuals the financial freedom to be creative and perhaps to produce works of genius. It places no restraints on how the five-year stipends are to be spent. The MIT recipients were Mr. Michael D. Woodford, a graduate student in the Department of Economics; Dr. Richard Mulligan, a postdoctoral fellow at the Center for Cancer Research and a fellow in Medicine at the Harvard Medical School; and Dr. Raphael C. Lee, a surgeon at the Massachusetts General Hospital and a research scientist in Electrical Engineering at MIT.

Two MIT faculty members were recipients of major international prizes during the past year. In September 1981, Institute Professor, Emeritus, Victor F. Weisskopf was selected as co-recipient (along with Professor Freeman Dyson and Professor Gerard 't Hooft) of the 1981 Wolf Prize in Physics. The Prizes are awarded by the Wolf Foundation "for outstanding contributions on behalf of mankind" in the fields of architecture, mathematics, chemistry, physics, and medicine. Professor Weisskopf and his co-recipients were awarded the Prize for "their outstanding contributions to theoretical physics, especially in the development and application of the quantum theory of fields."

In May 1982, Carroll L. Wilson (Mitsui Professor, Emeritus, in Problems of Contemporary Technology) was awarded the 1982 John and Alice Tyler Ecology/Energy Prize, considered the world's most prestigious prize in the area of energy and the environment. The Prize, awarded by the John and Alice Tyler Foundation, was given in recognition of Professor Wilson's leadership, throughout his career, in the assessment of global energy resources and in the development and management of atomic energy.

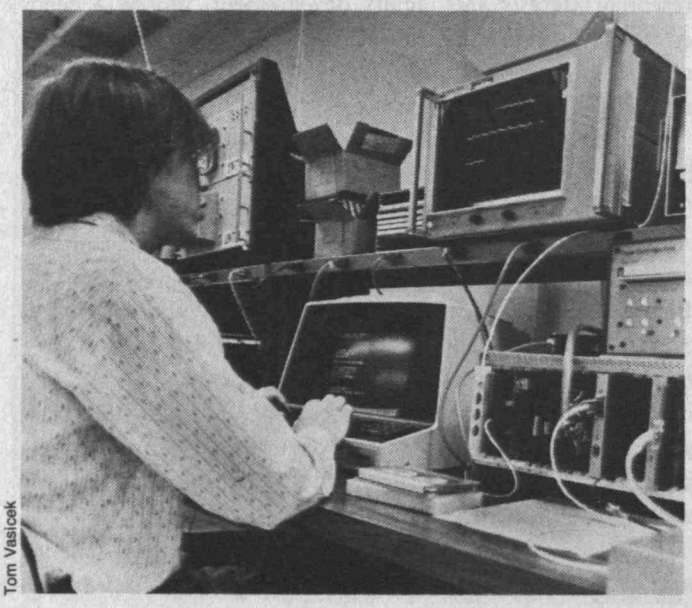
In February, Professor Arthur K. Kerman, Director of the Center for Theoretical Physics, and I, were named to the White House Science Council, a group of 13 scientists and engineers who will advise Dr. George A. Keyworth II, Director of the Office of Science and Technology Policy in the Executive Office of the President.

Within the Institute, Herman A. Haus, Elihu Thomson Professor of Electrical Engineering was selected by faculty colleagues to be the 1982-83 recipient of the James R. Killian, Jr. Faculty Achievement Award. The Award recognizes extraordinary professional accomplishments and service to the Institute. The Award citation reads, in part, "Dr. Haus's analytical work goes beyond solving the question of the moment. His talents enable him to bridge the gap between fundamental science and engineering applications — regularly putting novel engineering concepts on firm, theoretical ground ... and developing new methodologies to clarify and extend understanding..."

Several changes in the academic administration were announced during this past year. These changes include the selection of John M. Deutch as Dean of the School of Science (succeeding Robert A. Alberty). Dean Deutch took up his new responsibilities on March 1, 1982. New department heads announced during the year include Donald L.M. Blackmer, Department of Political Science (effective January 15, 1982); Gary A. Hack, Department of Urban Studies and Planning (effective August 1, 1982); Merton C. Flemings, Department of Materials Science and Engineering (effective September 1, 1982); Ann F. Friedlaender, Department of Economics (effective January 15, 1983); Joel Moses, Department of Electrical Engineering and Computer Science (effective September 1, 1981); John Myer, Department of Architecture (effective September 1, 1982, succeeding Professor Julian Beinart, who served as interim head during the year); T. Francis Ogilvie, Department of Ocean Engineering (effective February 1, 1982, succeeding Professor Chryssostomos Chryssostomidis, who served as acting head during the year); and Christopher T. Walsh, Department of Chemistry (effective July 1, 1982).

Other changes in the academic administration announced during the year included the appointment of H. James Brown as Director of the Harvard-MIT Joint Center for Urban Studies; Chryssostomos Chryssostomidis as Director of the MIT Sea Grant Program; Thomas H. Lee as Director of the Electric Power Systems Laboratory; Daniel H. Gould as Assistant to the Provost for Administration; Herbert H. Richardson as Associate Dean of the School of Engineering; Alvin J. Silk as Associate Dean of the Sloan School of Management; and Kenneth A. Smith as Vice President for Research (continuing as Associate Provost as well).

Several changes in the Institute's administration also were announced during the year. Among them were the ap-



Tom Vasicek

pointment of Patricia Bell Scott as Assistant Equal Opportunity Officer, William R. Dickson as Senior Vice President, Deborah A. Hoover as Executive Director of the MIT Council for the Arts, William D. MacLaurin as Director of the Office of Minority Education (succeeding Clarence G. Williams who had been serving as acting director), William L. Porter as Special Assistant to the President for the Arts, Shirley M. Picardi as Secretary of the Alumni Association, Arthur R. Wagman as Bursar, and Elizabeth J. Whittaker, as Assistant Secretary of the Corporation.

The Institute was saddened this year by the deaths of several longtime friends and colleagues. We miss their presence among us and are grateful for their contributions to this community.

Edward J. Hanley, a member of the MIT Corporation for 26 years and of its Executive Committee for 10 years, died in March 1982 at the age of 79. A distinguished leader of the steel industry, he was especially active in the life of the Institute, participating in numerous alumni committees and councils, and serving as president of the Alumni Association in 1959-60.

Charles E. Holt III, Professor of Biology, died in February 1982, at the age of 45. Widely recognized for his contributions as a research scientist, particularly in the genetics and physiology of development, "Ned" Holt's innovative approaches to laboratory teaching led to a reorganization of the entire laboratory instruction program in the Department of Biology.

Roman Jakobson, Institute Professor, Emeritus, known as the founder of modern phonology, died at the age of 85, in July 1982. A widely published author of some 500 books and essays, he was a monumental figure whose influence in linguistics and literary studies spanned nearly 70 years.

Roy Kaplow, who held a joint appointment as Professor in the Department of Materials Science and Engineering and in the Division for Study and Research in Education, died in January 1982 at the age of 49. Long active in faculty governance and service to the Institute, his research interests ranged from the materials field to solar energy to the use of computers for education.

In June 1982, Associate Professor of Meteorology, Emeritus, Delbar P. Keily, died at the age of 74 years. A specialist in the field of aircraft and meteorological instrumentation, he graduated from MIT in 1934 and spent his entire career at MIT, as researcher and then as faculty member until his retirement in 1973.

Paul V. Keyser, an MIT graduate, former MIT Corporation member, and retired executive vice president of the Mobil Oil Corporation, died in February 1982 at the age of 75. Highly regarded for his activities on behalf of the Corporation and its various committees, he was even more widely known for his service in every aspect of alumni affairs, including two consecutive terms as president of the Alumni Association in 1970-72.

Thomas F. Morrow, a class of 1935 alumnus and member of the MIT Corporation from 1963-68, died in June 1982, at the age of 69. A retired group vice president of the Chrysler Corporation, he was active in alumni affairs and was a longtime member of the Corporation Development Committee.

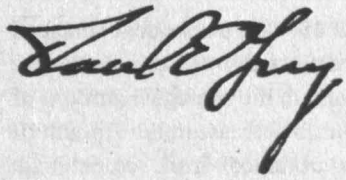
In August 1982, John T.R. Nickerson, Professor of Food Technology, Emeritus, died at the age of 76. A specialist in food preservation, Professor Nickerson received his bachelor's, master's, and doctorate degrees from MIT, and was a member of the teaching staff and faculty at the Institute from 1948 until his retirement in 1972.

In July 1982, Norman J. Padelford, Professor of International Relations, Emeritus, died at the age of 78. Instrumental in planning US policy on the establishment of the United Nations, he also served as consultant at the Department of State during World War II.

Thomas P. Pitre, chief administrator of financial aid at MIT for more than 30 years, died in February 1982 at the age of 83. Dean Pitre came to MIT as a faculty member in 1920, and later served in the Office of the Dean for Student Affairs, devoting much of his time to counseling students.

Raymond S. Stevens, a graduate of the class of 1919, former member of the MIT Corporation, and former president of Arthur D. Little Company, died in February 1982 at the age of 87. A participant in all the major capital drives of the Institute, he had a distinguished record of service to the Institute as an alumni leader.

Charles A. Thomas, a Life Member, Emeritus, of the MIT Corporation, died in March 1982, at the age of 82. A distinguished scientist and leader of the chemical industry and staunch supporter of MIT, he participated in the affairs of the Corporation, the Alumni Association, and the Institute for over 30 years.



Paul E. Gray
September 13, 1982

## Statistics for the Year

The following paragraphs report briefly on the various aspects of the Institute's activities and operations during 1981-82.

### Registration

In 1981-82 student enrollment was 9,510, compared with 9,365 in 1980-81. This total was comprised of 4,562 undergraduates (compared with 4,577 the previous year), and 4,948 graduate students (compared with 4,788 the previous year). Graduate students who entered MIT last year held degrees from 373 colleges and universities, 229 American and 144 foreign. The international student population was 1,956, representing 10 percent of the undergraduate and 30 percent of the graduate population. These students were citizens of 95 countries.

Degrees awarded by the Institute in 1981-82 included 1,128 bachelor's degrees, 1,118 master's degrees, 64 engineer's degrees, 403 doctoral degrees — a total of 2,713.

The number of women at MIT, both graduate and undergraduate, has continued to increase. In 1981-82, there were 1,879 women students (977 undergraduate and 902 graduate) at the Institute, compared with 1,737 (891 undergraduate and 846 graduate) in 1980-81. In September 1981, 257 first-year women entered MIT, representing 25 percent of the entering class.

In 1981-82, there were 929 minority* students (725 undergraduate and 204 graduate) at the Institute, compared with 779 (611 undergraduate and 168 graduate) in 1980-81. The first-year class entering in September 1981 included 224 minority students, representing 22 percent of the class.

### Student Financial Aid

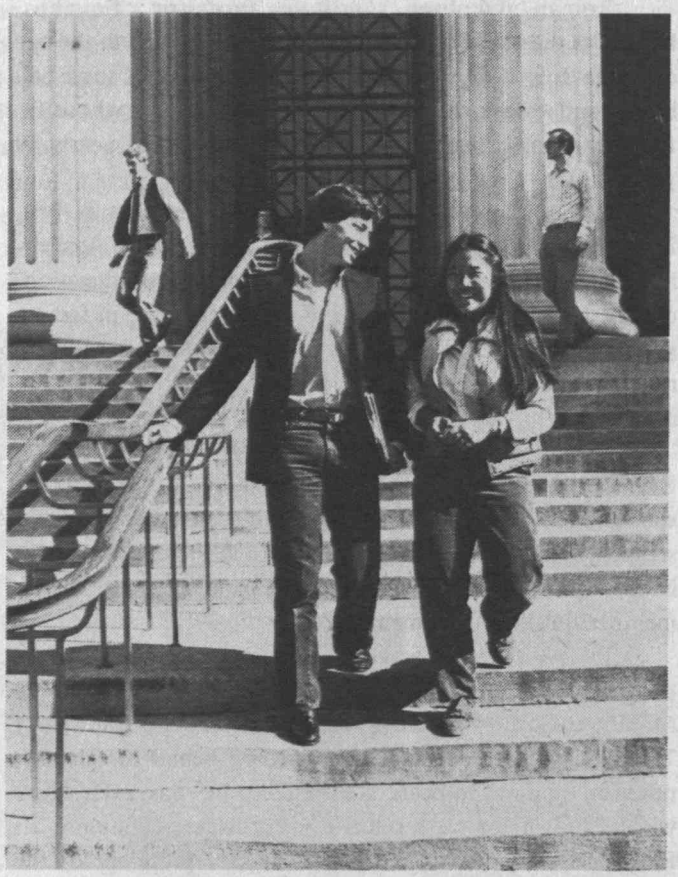
During the academic year 1981-82 the student financial aid program was again characterized by increases in the overall need for financial aid, and in the aggregate amount of grants made available. There was a decrease in the amount of MIT loans awarded. Loans obtained from commercial sources showed a significant increase.

A total of 2,441 undergraduates who demonstrated the need for assistance (54 percent of the enrollment) received $10,567,518 in grant aid and $2,022,177 in loans. The total, $12,589,695 represents a 22 percent increase in aid compared with last year.

Grant assistance was provided by the scholarship endowment in the amount of $3,299,809; by outside gifts and Federal allocations to MIT for scholarships in the amount of $1,787,163; and by direct grants to needy students totaling $2,697,047 (a 13 percent increase over last year). Scholarship assistance from MIT's own operating funds was provided to the extent of $2,634,822 (an 80 percent increase over last year's level and the largest allocation ever). The special program of scholarship aid to minority group students represented an additional $148,677 from specially designated funds. An additional 402 students received grants from outside agencies, irrespective of need. The undergraduate scholarship endowment was aided by the addition of new funds which represented an increase of about $1,101,339 and which raised the principal of the endowment to $30,512,551.

Loans totaling $2,022,177 were made to needy undergraduates — an 18 percent decrease from last year. Of this amount, $363,858 came from the Technology Loan Fund and $1,658,319 from the National Direct Loan Fund. Not included in the foregoing summary is an additional $7,386,862 obtained by undergraduates from state-administered Guaranteed Loan Programs and other outside sources. This represents a 36 percent increase in the use of these programs over last year.

Graduate students obtained $694,267 from the Technology Loan Fund, about half of which was loaned to international students and did not qualify for the Federal interest subsidies and guarantees available under the Guaranteed Student Loan Program. In addition, $295,175 was loaned by MIT under the Guaranteed Student Loan Program. The total $989,442 represents a significant increase over last year's level. Graduate students obtained $4,041,875



Jean Vivant

*Minority students include Blacks (non-Hispanics), Native Americans (including Alaskan Natives), Hispanics, and Asians or Pacific Islanders.*

from outside sources, under the Guaranteed Student Loan Program — almost exactly last year's level. The total loaned by MIT to both graduate and undergraduate students was $3,011,619, again about equal to last year's level.

**Career Planning and Placement**

The employment outlook for students graduating in 1981-82 was as full of contradiction as the economy as a whole. In spite of the recession, the number of employers coming to the Office to recruit was the largest on record — 450, up from 406 the year before. Nevertheless, a number of students in a number of disciplines were without jobs at graduation. It was a frustrating year for many students in architecture, chemical and civil engineering, geology, political science, and urban studies, but not for all students in these fields. In civil engineering, for example, students in structures generally fared well, while students in water resources fared badly. Students in chemical engineering did well if they interviewed early in the year. The oil industry was hungry for engineers in the fall and helped to bid up salaries sharply. The average offer to bachelor's degree candidates in chemical engineering rose 12 percent over the year before to $27,500; offers to master's candidates rose more than 15 percent, and offers to Ph.D. candidates jumped as much as 23 percent. But the industry reversed its hiring plans during the winter and made a minimum of offers in the spring.

Students responded to the cloudy job market by making active use of the Office. A total of 1,556 students and postdoctorals had 10,004 interviews with visiting employers. The number of interviews is the highest in the history of the Office. Eight hundred and twenty-seven students submitted resumes for the Science and Engineering Resume Book, also a record. The number of alumni using the Office rose to 419 from 356 the year before.

The underlying demand for technical people — the demand one can expect to see when the economy recovers — is very strong. More than 550 employers confirmed recruiting dates with the Office at the start of the year.

**Finances**

As reported by the Vice President for Financial Operations and the Treasurer, the total financial operations of the Institute, including sponsored research, amounted to $515,428,000, an increase of 8.2 percent over 1980-81. Education and general expenses — excluding the direct expenses of department and interdepartmental research, and the Lincoln Laboratory — amounted to $227,165,000 during 1981-82, compared to $199,924,000 in 1980-81. The direct expenses of campus departmental and interdepartmental sponsored research increased from $138,345,000 to $143,537,000; the direct expenses of the Lincoln Laboratory's sponsored research increased from $138,068,000 to $144,726,000 because of an overall increase in governmental research support.

For the first time in six years the financial operations of the Institute were not in balance, with expenses exceeding income by approximately $2 million. Current revenues used to meet the Institute's operating expenses totaled $505,941,000, augmented by $7,460,000 in unrestricted funds. The remaining $2,027,000 needed to meet expenses was made up of $975,000 in other fund balances and $1,052,000 in funds functioning as endowment.

The construction program of the Institute continued to make progress in 1981-82 with the book value of educational plant facilities increasing from $262,658,000 to $278,949,000.

At the end of the fiscal year, the Institute's investments, excluding retirement funds, students' notes receivable, and amounts due from educational plant, had a book value of $463,786,000 and a market value of $539,736,000. This compares to book and market values of $442,112,000 and $579,875,000 last year.

**Gifts**

Gifts, grants, and bequests to MIT from private donors decreased slightly to a total of $41,055,000 in 1981-82, compared with the record high of $42,934,000 in 1980-81. The 1981-82 figure includes unrestricted direct gifts to the Alumni Fund of $2,700,000 which constituted part of the total $7,715,000 reported by the Alumni Fund in 1981-82.

**Physical Plant and Campus Environment**

During the year we dedicated the Health Services Center Building, the new home of the Medical Department, and the associated building which is home for the Whitaker College of Health Sciences, Technology, and Management. These splendid new structures, which will be fully completed in fall of 1982, are landmarks at MIT in two respects. First, they represent the most costly construction project ever undertaken at the Institute. Second, they comprise the first new construction for academic purposes east of Ames Street, and represent the first steps in what will be a decade-long redevelopment of that area to better serve the long-term needs of the Institute.

Other major building projects during the year included the completion and occupancy of the dormitory at 500 Memorial Drive; the opening of 70 Memorial Drive, which provides classrooms and offices for the Program in Science, Technology, and Society and the Sloan School; and the completely renovated classroom and office building at One Amherst Street for the Sloan School and the Energy Laboratory.

Major renovation projects completed during the year were space for the Department of Architecture on the third and fourth floors of the former Epsco Building on the north

side of the campus, and the first and basement floors in Building 35 for the Laboratory for Manufacturing and Productivity.

Major projects under construction are the EG&G (Edgerton, Germeshausen & Grier) Education Center, a five story brick building to be connected to the Fairchild Building link and Building 24; the Arts and Media Technology Building on Ames Street next to the Seeley G. Mudd Building; a new 24-bed residence and conference facility adjacent to and in support of Endicott House in Dedham, Mass.; renovations to the basement, first, and third floors of the Sloan Building on Memorial Drive, and to the Plasma Fusion Tandem Mirror Project in the Nabisco Building on Albany Street.

The Dining Program originally proposed by the Committee on Campus Dining completed its second year of operation. The efforts of the House Commons Committees, the Dining Advisory Board, students, and staff have contributed greatly to its success.

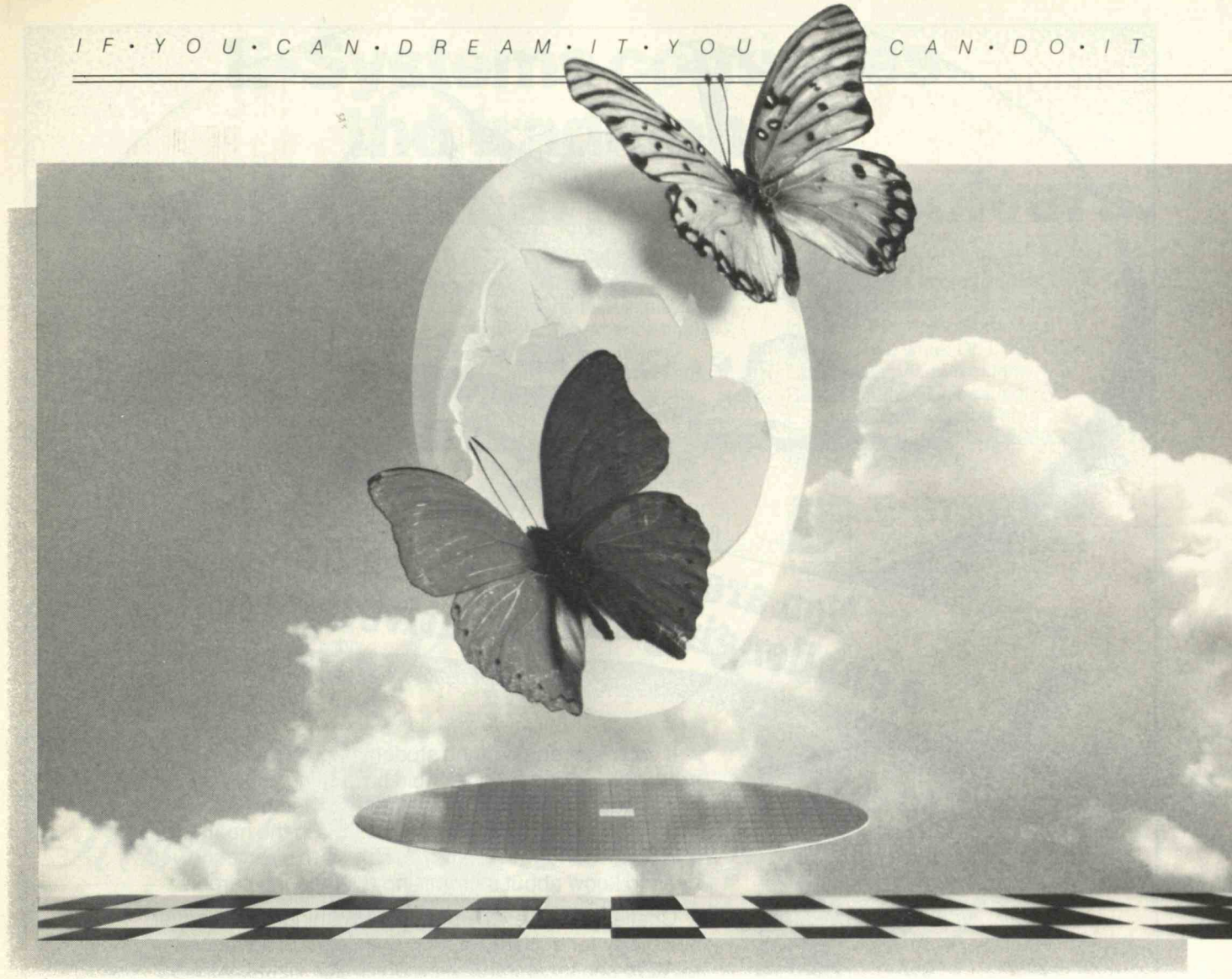
Dining-related issues involving the east side of campus received considerable attention this year. Goody, Clancy and Associates, Inc. completed their study of Walker Memorial. This study explored ways to provide dining facilities for the students on the east side of campus, permitting them to have commons dining and to conduct dining-related programs, while still accommodating a large lunchtime clientele from throughout the MIT community. The report presented a number of alternatives and described the difficulty of using this facility for these multiple purposes. The physical placement and size of spaces, the constraints on changes within Morss Hall, and the economics of the project are the major factors which limit reaching the goal.

One of the alternatives mentioned in the report was the installation of kitchens in East Campus and Senior House. Students in these houses have been on a "limited" commons participation until such time as the issue of dining for east campus residents was resolved. Residents of these houses developed a well-conceived proposal for placement and operation of kitchens in their respective houses, a proposal which was accepted by the administration, and approved by the Corporation. The student client team and appropriate administrative offices are now beginning the programming and design phases for the new kitchens. The student group responsible for the proposal was honored by being chosen as a recipient of one of the William L. Stewart, Jr. Awards.

In conjunction with the Safety Office, a program of smoke detector installation to meet new fire safety codes is under way. Approximately 2,200 smoke detectors are to be installed in all dormitory rooms and all apartments. Currently completed are Eastgate, Westgate, Baker House, and MacGregor House. The balance of the system is to be completed over the next year.

Calvin Campbell

I F · Y O U · C A N · D R E A M · I T · Y O U · C A N · D O · I T



# *Expand the mind of the microchip.*

Remember when electronic calculators were considered a luxury? Well, consider this sign seen recently outside a gasoline station in Schenectady, New York: "Free calculator with an oil change."

That's just one sign of the enormous impact microchips have had on the way we do everything – from banking to game-playing.

But how will we use microchips that are smarter, faster, more reliable, and less expensive to design? How will these new microchips be used to improve systems, products, and processes? As one GE engineer puts it, "The sky's the limit!"

That sky is replete with a number of integrated circuit concepts that GE is applying right now.

There's the custom IC, a chip that performs highly specialized functions. Traditionally, creating this chip has been an expensive, time-consuming job. So we're working on ways to cut design time and cost.

We're using computer-aided design (CAD) to design and simulate chips right on computer screens. We're also developing gate arrays, a system that allows you to build inexpensive prototype chips that can be "played" in systems before the final design is fixed.

Another area that GE is developing is VLSI (Very Large Scale Integrated) circuits. These ICs will eventually squeeze one million transistors onto a single chip.

Where will all this super electronic power be applied? GE engineering manager Don Paterson sees it this way:

"At GE you can innovate from the system down to the chip to create... whatever ignites your imagination."

In other words, you can dream it...and do it.

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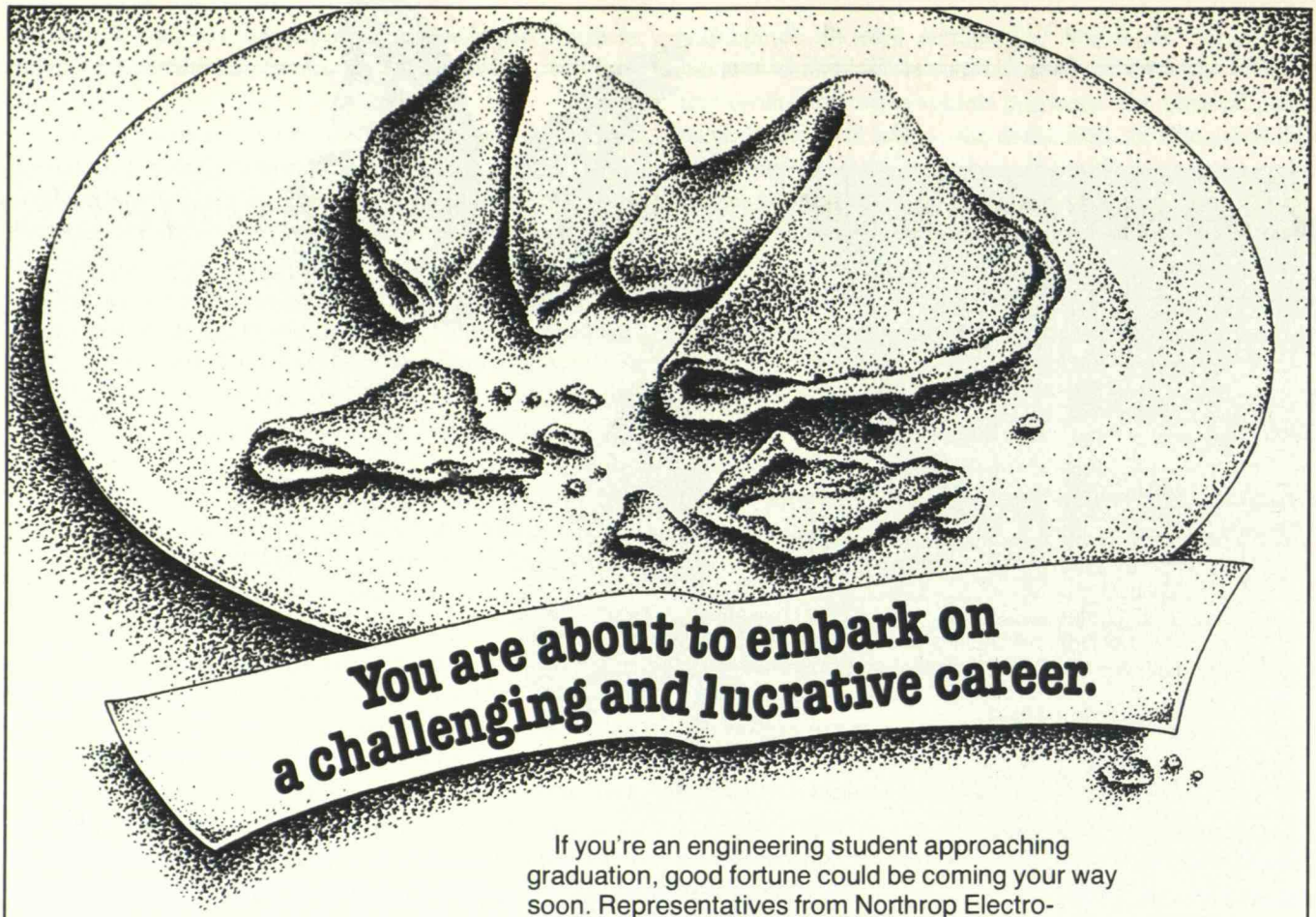

# You are about to embark on a challenging and lucrative career.

If you're an engineering student approaching graduation, good fortune could be coming your way soon. Representatives from Northrop Electro-Mechanical Division will be on campus in the near future and by meeting with them, you can learn everything you need to know about a promising engineering career.

Challenge and excitement are two things you'll never be hungry for at Northrop. We specialize in advanced passive sensor technologies which use visual, infrared or nonimaging detectors to help our military forces in rescue and combat operations. And with more than 50 programs presently underway, we can offer you a wide variety of career directions.

Every talented engineer has a great potential to make money here. But when we say that you'll have a lucrative career at Northrop, money isn't all that we have in mind. You'll also find a wealth of opportunity to learn and advance, plus a benefits package of extraordinary value.

Visit your placement office to find out when our representatives will be at your college.

If you are unable to meet with one of our representatives, please forward your resume to:

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# E-Systems continues the tradition of the world's great problem solvers.

Unquestionably, Leonardo da Vinci possessed one of the world's great minds. Not only renowned as a painter and sculptor, da Vinci also applied his exceptional talents to the mechanics of flight, to cartography for planning military campaigns, and even astronomy.

Today, scientists and engineers at E-Systems continue the tradition by expanding the practical application of advanced technology. E-Systems uses the principles of flight mechanics as the basis for major modifications to aircraft, expands basic cartography to encompass highly sophisticated guidance and command and control systems, and has designed and built a system that greatly expands man's ability to study the universe.

That's only a small segment of the tough problems E-Systems engineers solve in the area of antennas, communications, data acquisition, processing, storage and retrieval systems and other systems applications for intelligence and reconnaissance — systems which are often the first of a kind in the world.

For a reprint of the da Vinci illustration and information on career opportunities with E-Systems in Texas, Florida, Indiana, Utah, and Virginia, write: Dr. Lloyd K. Lauderdale, Vice President Research and Engineering, E-Systems, Inc., Corporate Headquarters, P. O. Box 226030, Dallas, Texas 75266.

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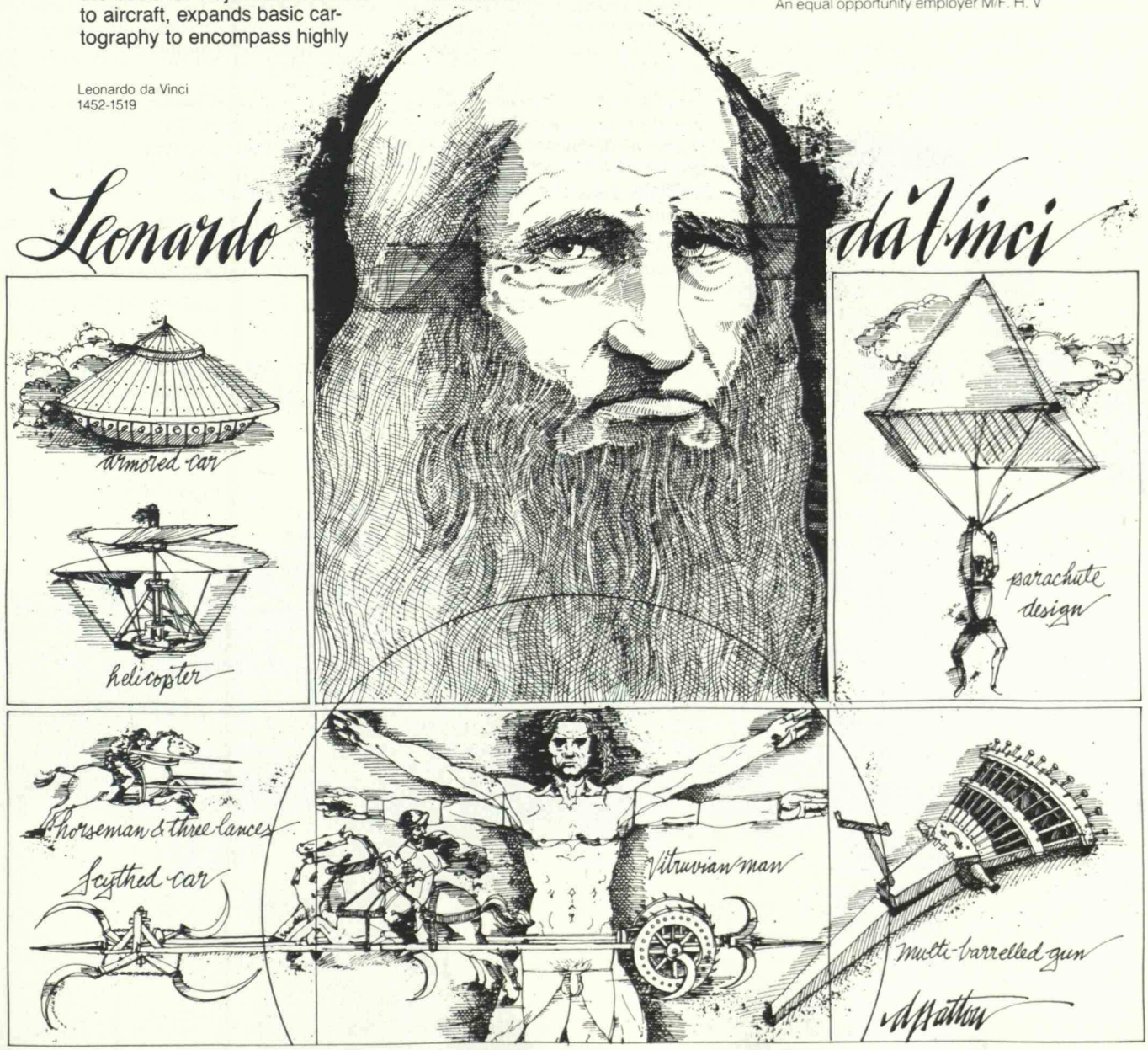
Leonardo da Vinci
1452-1519



# Luis Castellanos mines copper with software.

Most copper is found deep underground. But the Bell System's 995 million miles of copper cable have tons of it above and below ground. That copper provides vital circuit paths to transmit customer voice, data and video signals for today's Information Age needs.

And Luis Castellanos, seven years out of undergraduate school, supervises one of the groups that helps Bell System companies "mine" all that copper. He works with one of the largest computer hardware and software systems in the world—the Trunks Integrated Record Keeping System (TIRKS). Every day it "mines" the vast Bell network for available circuits and equipment. As a result of efficient use of network facilities, the Bell System saves millions by eliminating the need for certain capital expenditures.

Plus, there's more to TIRKS than "mining copper." It also configures circuits and assigns components needed for each circuit path. That allows Bell companies to respond faster to customer requests for complex services like video and data transmission. Employees are more productive too, because TIRKS helps them set up circuits and forecast facility needs.

Before TIRKS was available, keeping track of communications circuits and facilities required enormous amounts of paperwork and manual calculation. Every day, the average Bell System company handles orders involving 1500 circuits and up to 7500 individual components associated with them. Each detail has to be specified and accounted for.

Now, thanks to people like Luis, TIRKS keeps track of all that information instantaneously using computers. Information is up-to-date. It's instantly available. And it's more accurate.

According to computer scientists like Luis, the benefits from TIRKS are just beginning. He believes that, as more computer hardware and software systems like TIRKS interact, new benefits for customers may be possible, as well as additional productivity increases for employees.

Luis joined Bell Labs with a B.S. in computer science from Pratt Institute. Under a company-sponsored graduate study program, he attended Stevens Institute of Technology for his M.S. in computer science. At the same time, he worked part-time assuming responsibility for a large piece of TIRKS software. Working with design teams, he gained valuable insight from experienced members. Now, his technical performance has earned him a promotion to supervisor.

If you're interested in similar challenging employment opportunities at Bell Labs, write:

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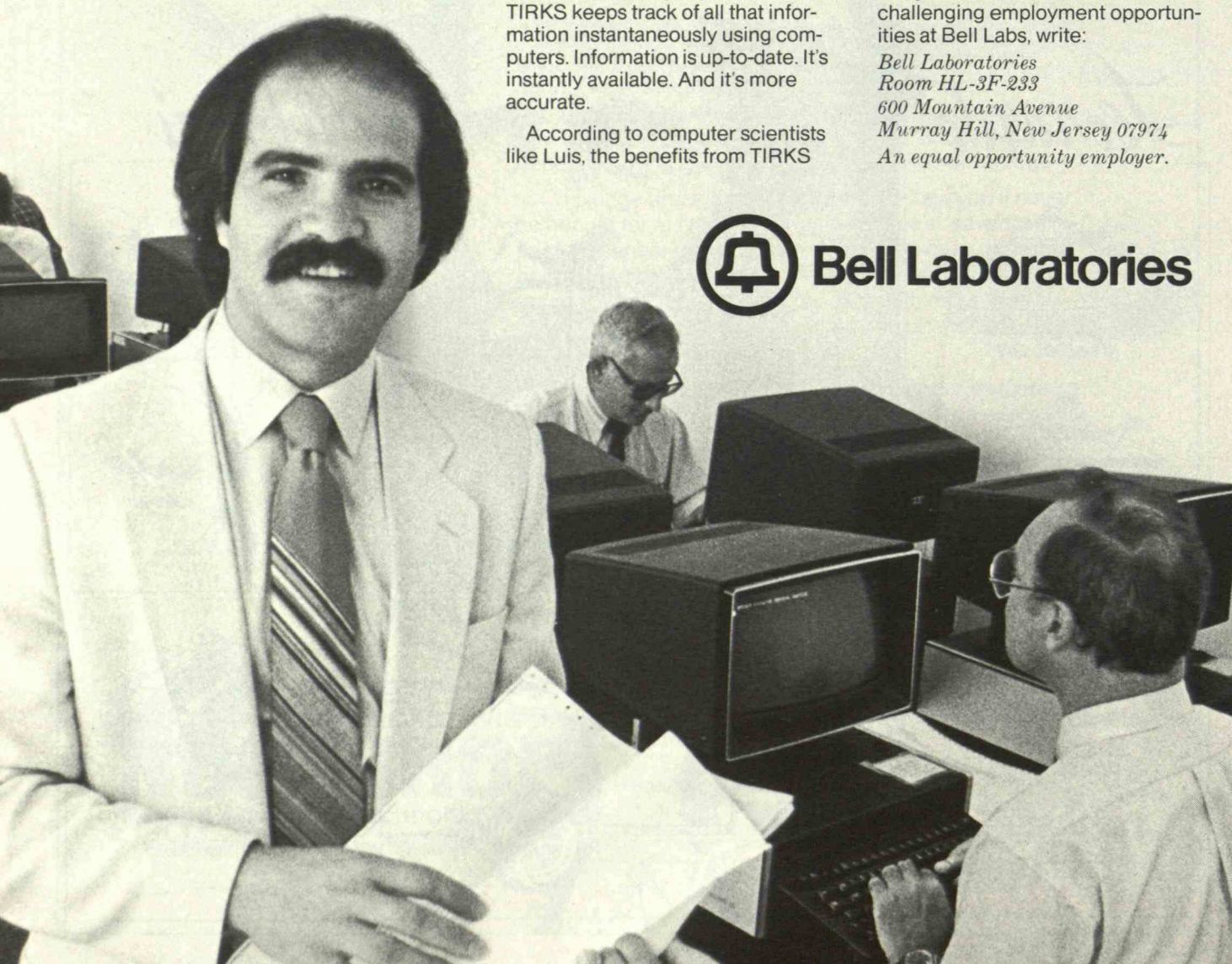

Bell Laboratories

Organizations are still grappling with how to apply the power of computers, not merely to store data but to aid top-level decision makers.

whole. First, there was a clear line of authority; there was hence no question to whom the system should report, who should have access to its information, and who would be subject to the commands contained in its daily printouts. Second, the level of reality was easier to deal with. All initiatives were new (or at least treated as such); none already had a reality; all concerned matters that had to be undertaken in a hurry. Third, the matter of the level of abstraction was skirted by treating all subjects as equal, a plausible approach when one deals with 15 subject areas, all concerned with one main topic.

I do not believe it follows, however, that such a system cannot enhance substantially the productivity of top management in a more diffuse, complex, multilevel system. This would include the White House as well as large corporations. But it might require, as it is introduced, some clarification of the lines of authority, a classification (or "code") to separate proclamations and expressions of goodwill from policy commitments, and these from the record of actual accomplishments. And, if the system is not to be overloaded with details, it may well require a separation of information into bits, subcontexts, and contexts. For example, information about unemployment (bits), labor policies (subcontext), and economic policies (context) fit into each other like Chinese nesting boxes and cannot be treated as coequal items.

None of these steps is easy to undertake, from a data-processing viewpoint, and all carry a measure of political hazard of the kind entailed in clarifying the lines of authority and separating useful fictions from facts. In a corporation, for example, the chief executive officer may incur such cost if the tracking computer forces him to state to which vice-president the divisions are to report and on what matters—an issue he may not wish to have cleared up if he sees a benefit in keeping his vice-presidents in sharp contest with each other about duties and authority. In the end, it seems that what determines whether or not such a system will be used is the calculation of the size of the benefits a more productive system promises versus the potential political costs. This is an issue that organizations are still grappling with as they try to apply the power of computers, using them not merely to store and manipulate data but to aid top-level decision makers.

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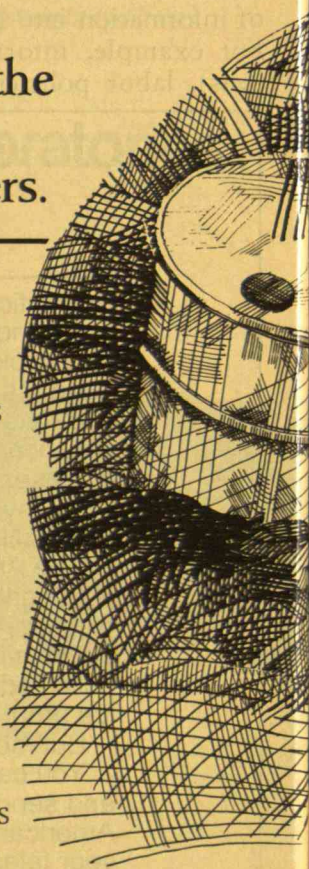
AMITAI ETZIONI is University Professor and director of the Center for Policy Research at The George Washington University in Washington, D.C. He served as senior adviser in the White House in 1979-80. This article is based on ideas explored in his book *An Immodest Agenda* (McGraw-Hill, 1982).

# We're doing what has to be done.

# Danger– Handle With Care!

**Love Canal dramatized the dangers of hazardous wastes. Business, government, and the insurance industry are showing that today's dumps need not be tomorrow's disasters.**

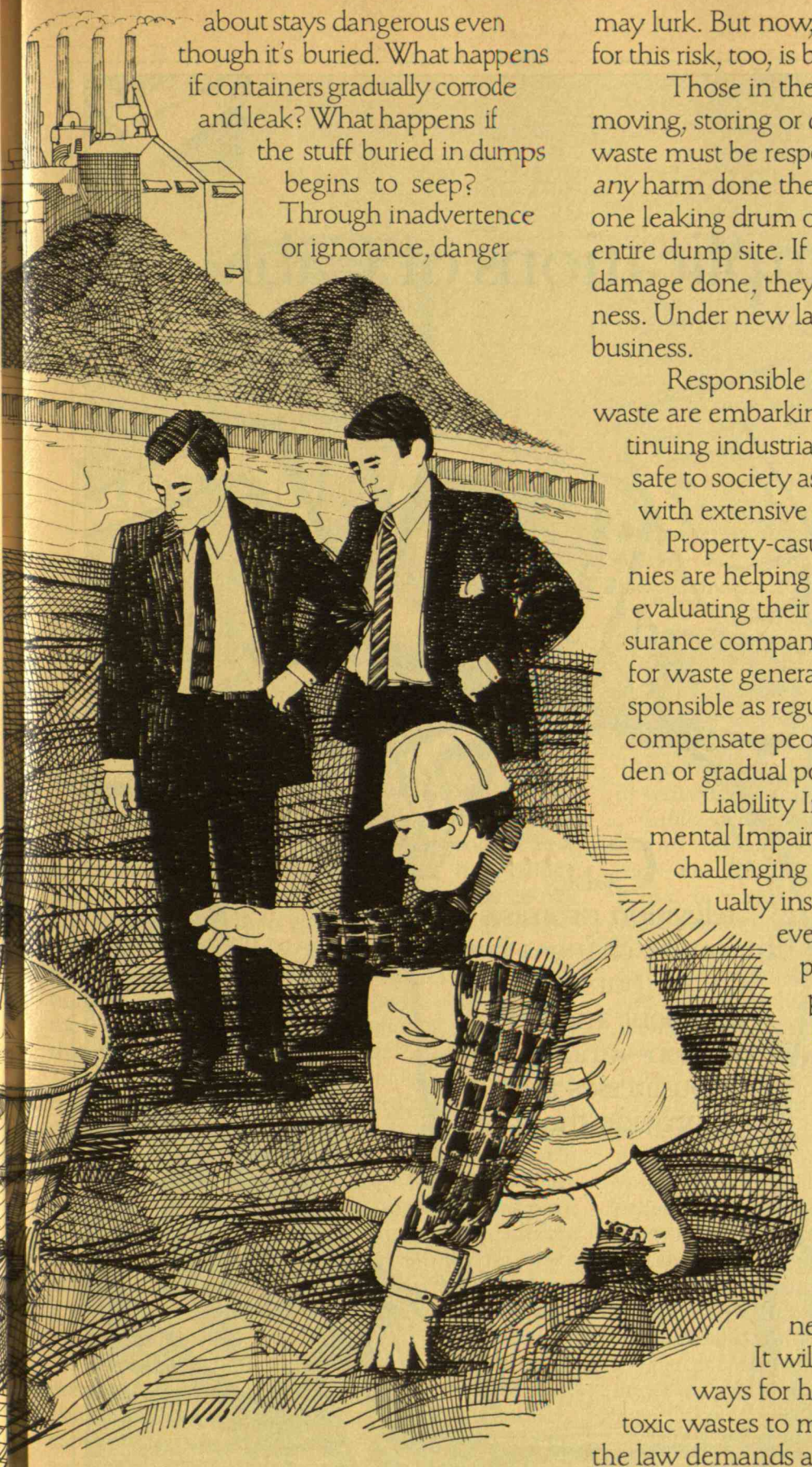


In a modern, heavily-industrialized society, waste materials are abundant and, in some cases, dangerous. Toxic leftovers from many industrial processes can pollute the environment, contaminate the water, and threaten the public safety. And, let's face it, serious accidents have occurred.

Today, the combined efforts of legislators, regulators, responsible waste-generating companies, the insurance business, and a concerned public are being felt.

New laws and standards go a long way toward making sure that firms that produce, move, store, or dispose of dangerous substances do so with care. Government tests and inspections are meant to assure compliance and minimize risk. Concerned industries have developed new technology and methods for safe waste disposal. But with materials this potentially dangerous, the best of care may not prevent every accident.

Although any accident with hazardous substances is bad news, some accidents are worse than others. And more insidious. Sudden spills and fires are quickly found and remedies quickly applied. Liability insurance for those accidents has been available for some time. But the material we're talking



about stays dangerous even though it's buried. What happens if containers gradually corrode and leak? What happens if the stuff buried in dumps begins to seep? Through inadvertence or ignorance, danger may lurk. But now, liability insurance for this risk, too, is becoming available.

Those in the business of producing, moving, storing or disposing of dangerous waste must be responsible to the public for *any* harm done them—sudden or gradual—one leaking drum or the slow leaking of an entire dump site. If they can't pay for the damage done, they shouldn't be in the business. Under new law, they *can't* be in the business.

Responsible handlers of hazardous waste are embarking on a difficult path—continuing industrial activity in a manner as safe to society as possible and in compliance with extensive governmental regulation.

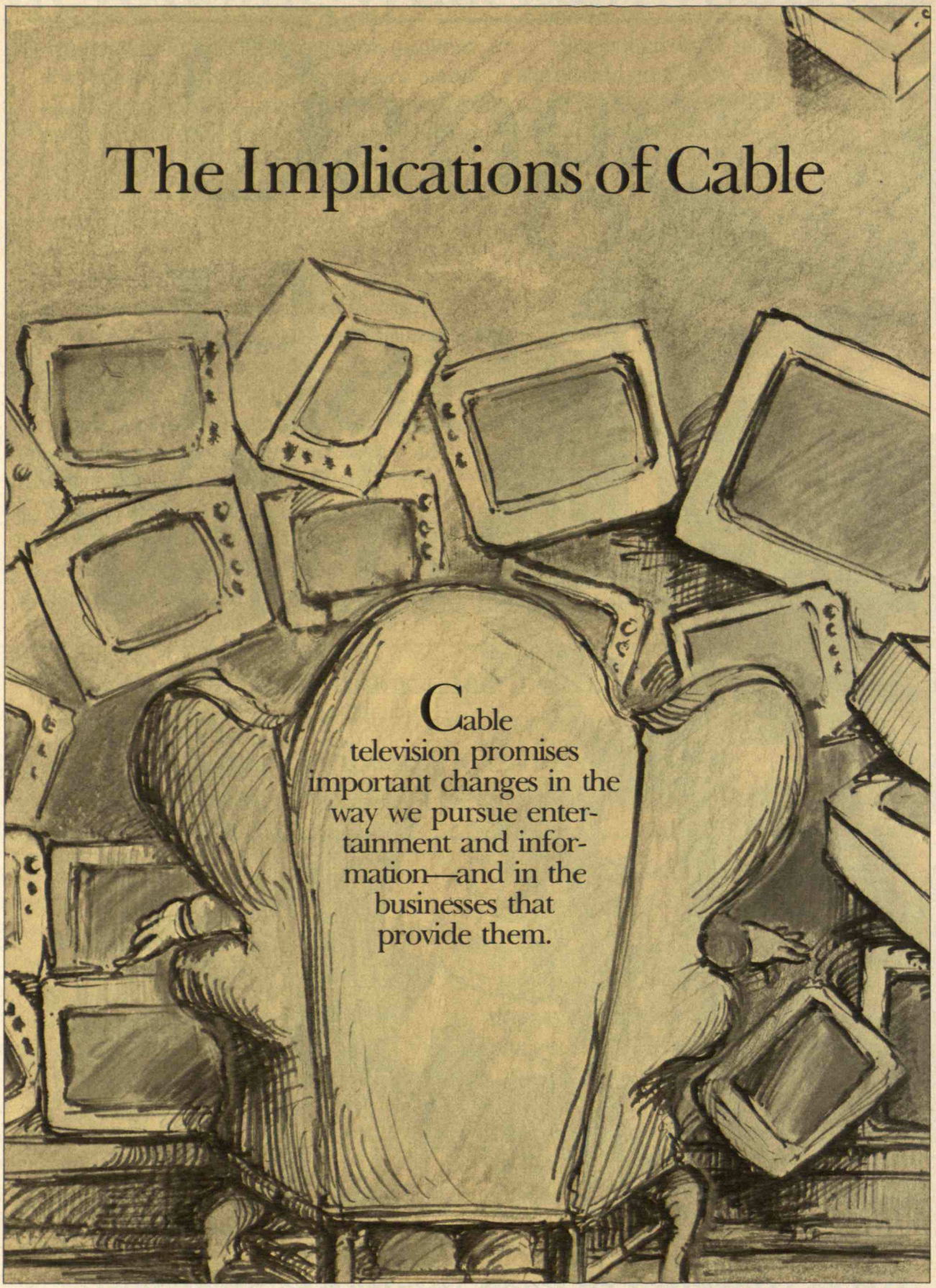
Property-casualty insurance companies are helping those waste generators by evaluating their risk potential. And now, insurance companies have devised a way for waste generators to be financially responsible as regulations require, able to compensate people harmed by either sudden or gradual pollution.

Liability Insurance for Environmental Impairment is one of the most challenging coverages property-casualty insurance companies have ever been asked to provide. The potential for loss to both people and property is large and little known. But if proper safety standards are issued and enforced by either federal or state government, and if insurance companies are allowed to administer the coverage with some sense of certainty, this new insurance can do a job. It will be one of the best ways for handlers and disposers of toxic wastes to meet the responsibility that the law demands and the public deserves.

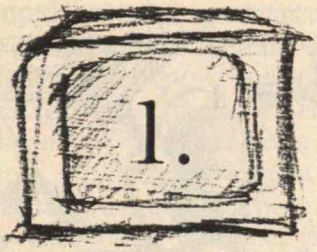
# We're working to keep insurance affordable.

This message presented by the **American Insurance Association,** 85 John Street, New York, NY 10038

# The Implications of Cable



Cable television promises important changes in the way we pursue entertainment and information—and in the businesses that provide them.




# More Messages from the Medium

BY ROBERT D. KAHN

THE earliest automobiles were called "horseless carriages" because that was the only way people at the time understood the new technology. This is not very different from calling today's cable systems "television." And just as the automobile went on to alter American life in important and lasting ways, so too may cable communications. Historically, cable has provided quality reception for remotely located consumers, but today it is the purveyor of myriad programming and services that redefine what we mean by, and expect from, TV.

Cable began to expand in the mid-1970s when several court decisions obliged the Federal Communications Commission (FCC) to relax some serious constraints. Until then, cable companies could not rely on national cable program sources but had to function on a local basis. In addition, space satellites were opened to commercial use, offering the cable industry an opportunity to establish its own national networks and to "cablecast" programming that broadcast TV—the established networks—either could not or would not offer.

Cable programming was linked to satellite transmission for the first time in 1975 when Time, Inc. established the first national network to distribute cable programs to local operators. And innovations such as all-movie channels—which showed current, uncut, commercial-free feature films—made a great impact on urban markets. In the three years from 1977 to 1980, cable subscribership went from 11 to 14 million households. Today that number stands at approximately 28 million, and the industry reports that 250,000 households per month are being wired for cable. Approximately 34 percent of U.S. residences now receive cable, with half the homes having access to cable subscribing to it.

Cable differs from broadcast television in three fundamental ways:

*Cable offers expanded channel capacity.* Cable systems installed today promise upwards of 100 channels, offering local communities a varied, and unprecedented, communications menu. Not only do these channels offer today's mass-oriented broadcasting, but cable also offers "narrowcasting"—special programs going out to special-interest viewers.

*Cable offers two-way communication.* While the majority of cable systems are now limited to conventional one-way communication, newer systems also offer the option of consumer-originated messages. These may take the form of polling, emergency calls, or requests for information.

*Cable can easily be coupled with other communications technologies.* Cable is one medium that can carry virtually all others: newspapers, radio, film, books, even still pictures. While cable can't really substitute for a visit to the movies or a museum, it can distribute images widely and inexpensively. Linking computer technology with cable—in transmitting data, for example—is especially powerful.

One sign of cable's maturity is the profusion of new networks. A recent count by the National Cable Television Association identified 51 national satellite-distributed cable networks, including three all-news channels, two all-sports channels, four religious networks, three movie channels, a health network, a Spanish-language network, and numerous others. Soon cable systems will even carry an electronic-games channel.

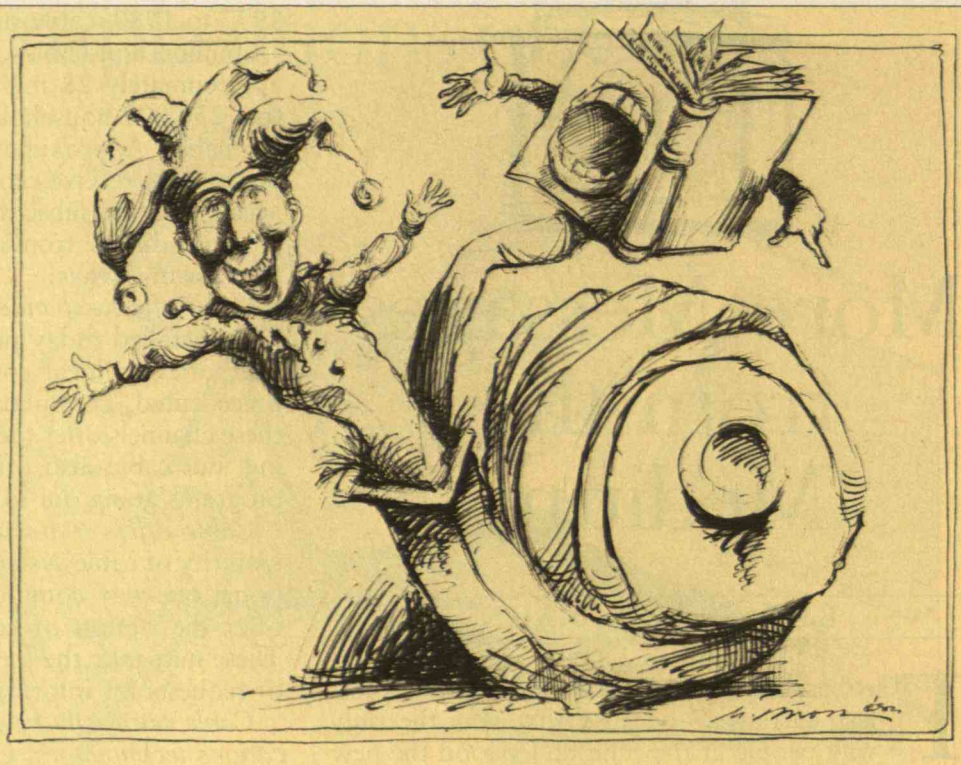
Cable has begun to cut into the historic dominance of television programming by the nation's three broadcast networks. In some cable-serviced communities, the major networks combined attract only 70 percent and less of the audience. In the United States overall, the three networks' share of prime-time ratings declined from 92 percent in 1979 to 81 percent in 1981.

Cable offers three kinds of programming: basic programming, pay programming, and two-way services. "Basic" is covered by the monthly subscription

ILLUSTRATIONS: GEOFFREY MOSS

fee paid by the customer. This "first tier" closely resembles conventional television and must (under federal law) carry local broadcast-TV stations. The first tier also frequently includes so-called "superstations" such as WGN-Chicago or WTBS-Atlanta—independent broadcast stations that specialize in sports and entertainment and are transmitted by satellite to hundreds of local cable systems. Basic services also include "community-access" programs generated within the cable-served community, under franchise terms negotiated between the operator and the local political jurisdiction.

"Pay TV" is the second tier: the system operator can offer subscribers numerous networks, in addition to the basic set, at additional cost. Moreover, special one-time programs such as concerts and boxing matches may be charged to subscribers on a "pay-for-view" basis.



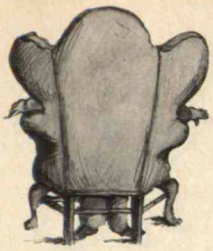
In the fierce competition for local franchises, a cable company presents itself as a "common carrier," available to serve much of the host community's needs.

Pay-TV programming accounts for much of cable's popularity and certainly contributes to its profitability; many subscribers appear willing to pay for the uninterrupted programs unavailable on commercial broadcast networks. Revenue from pay-cable channels has been rising steadily. According to Paul Kagan Associates, a leading cable analysis firm, approximately 19 million subscriptions to cable programs were sold in 1982. A conservative estimate of overall industry revenue for the year just ended is $4.36 billion. Kagan projects overall industry revenues to reach $16.6 billion by 1990, fueled largely by pay services.

But there are limits to pay cable's popularity. A 1981 study conducted by Benton and Bowles, Inc., a marketing research firm, determined that nearly half of those cable subscribers who presently reject pay TV would buy it if it were less expensive, even if this meant that advertising would have to accompany programming. In fact, cable viewers can expect to see more and more advertising over both basic and pay-cable channels. According to *Marketing News*, 70 percent of cable stations already seek advertising.

Two-way services constitute the third programming form that cable-TV systems make available. These services are now offered to only a fraction of the communities wired for cable, but they are becoming standard as new cable systems are installed. The offerings range from home banking, energy management, and security alarms to medical referrals and information-retrieval systems.

The best-known two-way system is Warner-



Amex's QUBE, used by 38,000 residents of Columbus, Ohio. Using the five-button keyboard distributed to every household served by QUBE, consumers transmit elementary messages that are processed by a computer at the "headend" (the operator's central facility). For example, viewers may request a copy of a recipe demonstrated on a cooking program by flicking a switch on their home terminal; they will later receive a copy of the recipe by mail.

QUBE has polled viewers for their opinions on everything from politics to TV shows, and once had them collectively "quarterback" a local football game. Warner-Amex loses money on QUBE in Columbus, but the two-way channel seems to have paid off in the highly competitive "franchise wars"—where cities must choose among competing cable companies before granting a monopoly contract. By breaking new ground with QUBE, Warner-Amex won a reputation for state-of-the-art technology, which likely helped it go on to win franchises in Cincinnati, Houston, Dallas, Pittsburgh, and St. Louis.

But not everyone is enthralled with cable's two-way capabilities: the potential for abuse is considerable. Accounts of the pay-TV programs individual subscribers watch, from special entertainment events to pornography, are monitored routinely. Operators of two-way systems are privy to polling results, purchase decisions, personal schedules, and whatever other household and commercial transactions subscribers make. Like the old-time village switchboard operator, today's cable operators could know more about us than we wish, with far more serious consequences.

In the fierce competition for local franchises, a cable company presents itself—in effect—as a "common carrier," available to serve much of the host community's communication needs. According to Michael Dann of ABC Video Enterprises, "Cable must be seen as a new utility, a utility people will use when they need and want it, not so much for entertainment but for information and services."

But cable does not operate as a utility—cable operators decide independently what programs to carry and what two-way services to provide. For example, if an entrepreneur develops an improved way to offer security and emergency services over cable, the operator that offers a security option of its own can either deny this competitor access to the system or charge prohibitive rates.

The issue of equal access to cable, and whether it should be defined as a common carrier, was actively debated last spring in the California legislature. Assemblyman Richard Robinson, a moderate Democrat from Orange County, introduced a bill to regulate the California cable industry—the nation's largest—as a public utility. Robinson argued that the installation and operation of a cable system should be separate from the control of its programming. The bill included a series of equal-access provisions to stimulate the use of cable by California's "knowledge industries," and to promote widespread reliance on cable as an alternative to the phone company. Robinson's measure was soundly defeated after industry opposition was mobilized. For now, California remains among the nation's 39 unregulated cable states.

"Information equity," like equal access, is another issue suggested by defining cable TV as an information utility. With the advent of some cable services, viewers pay for what used to be free. For example, a whole new set of children's programming, adult-education offerings, and information services will be available only to those who can afford it. Les Brown, editor-in-chief of *Channels* magazine, quips that society may eventually be required to provide "information stamps," akin to today's food stamps, to establish minimum access to information.

Questions of information equity, equal access, and privacy safeguards arise from the cable industry's embryonic moves into the "information age." But the industry is approaching a watershed: it may soon have to choose between continuing exclusively in entertainment—eventually competing with the major broadcast networks—and evolving to provide information services such as data transmission and teleconferencing in competition with AT&T.

If cable firms continue to move in the latter direction—that is, if they function like utilities—the more they will be treated like utilities and face frequent political challenges. Such a cable industry must accept regulatory oversight and content itself with the bargain Americans have traditionally made with their utilities—equitable and affordable services in exchange for fair and protected profits. But so far, the industry has resisted even the thinnest local regulation, and Washington and the state houses have yet to seriously assert themselves.

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ROBERT D. KAHN, Ed.D., is a member of the board of directors of the Davis (Calif.) Cable Cooperative. Until recently he was manager of publications and information for the California Office of Appropriate Technology.

# Cable's Economic Impacts

BY MARTIN L. ERNST

AFTER Gutenberg invented printing, massive amounts of information could be made widely available, often at little or no direct cost to users. Disseminating information no longer depended on the scarce resource of skilled and dedicated copyists; instead, information could be provided by a greater supply of far more productive labor. Fulfilling the print revolution required many other innovations, however. New industries had to supply paper, ink, and printing and binding equipment. Writers, publishers, and printers had to establish new business practices to work together effectively. New laws, such as copyright, were needed to provide economic incentives to create information. And new institutions, such as libraries and compulsory education, evolved as nations recognized the economic and social values of literacy and widespread knowledge. The result was that information was democratized—and, of course, copyists and parchment makers disappeared.

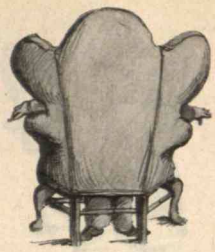
Cable systems and related technologies may well contribute to an equally significant set of changes. Large multichannel cable systems, low-power TV (permitting closer geographic use of the same broadcast frequencies), direct-broadcast services (whose authorization involves expanding the portion of the electromagnetic spectrum devoted to TV services), and, eventually, fiber-optic networks (that can provide multichannel capabilities far exceeding those of current coaxial cable) may convert a scarce resource—broadcast-TV channels—into an abundant commodity. And coupling these systems with advances in electronics, such as in computers, videotape systems, and videodiscs, may yield enormous impacts.

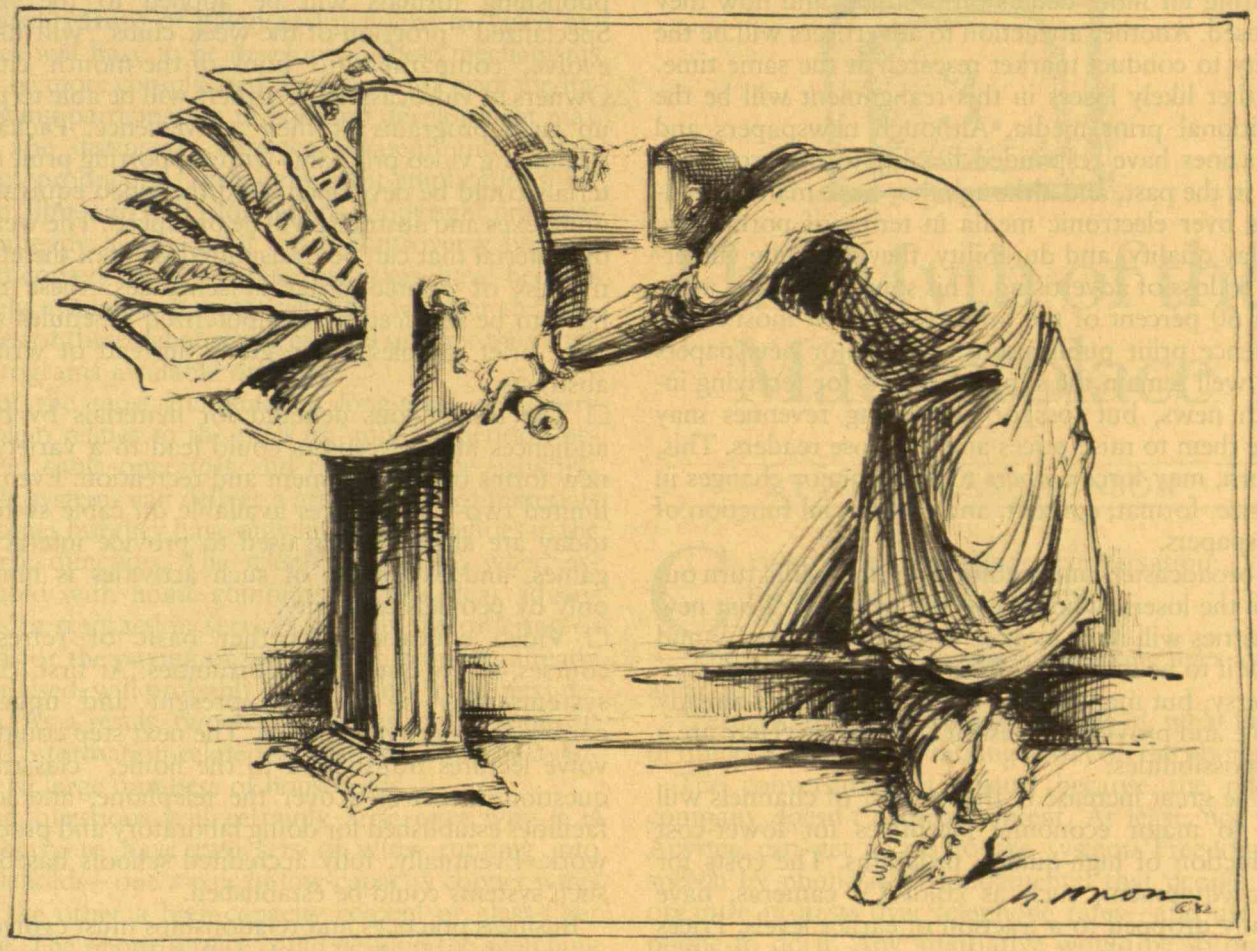
Historically, the scarcity of local broadcast-TV franchises, especially those for the higher-quality VHF channels, made them very valuable business properties; because the choice of channels was limited, the audience was highly concentrated. Networks and local stations competed for this audience by appealing to the broadest possible segments. At least for prime viewing periods, they could afford to produce elaborate and expensive programming. Advertising, the system's means of financial support, similarly focused on goods and services with mass appeal. As the viewing population grew, advertising rates per broadcast minute also grew. Ultimately, television advertising rates became the standard, or "umbrella," for other media rates, including those of major newspapers and national magazines.

The early cable systems had little impact on the structure of the broadcast industry. Few cable channels were available, programming was restricted to locally produced materials, and the systems tended to be regarded simply as grandiose antennnas for providing better reception.

But the large-capacity systems now being put in place, free from programming restrictions and offering 50 or more channels, are a totally different kind of proposition. Because of the large profits anticipated from pay TV and other new types of programming, local cable franchises have increased greatly in value. This has permitted local authorities to make far better bargains during franchise negotiations—bargains that usually involve lower basic connection charges for a larger set of free broadcast services and more channels for community use. Moreover, though early cable systems were priced to recover their costs entirely from basic connection charges, newer ones will likely require additional monthly revenues of at least $25 to $30 per connection from either viewers or advertising if they are to be profitable.

The differences between traditional broadcast operations and future cable systems may be quite striking. Cable-system operators will have to recover greater investments but will have more direct relationships with viewers and better records of their interests. Most important, operators will be able to de-

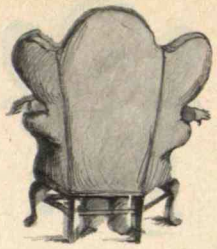




**Because of the large profits anticipated from pay TV and other new types of programming, local cable franchises have increased greatly in value.**

liver programs at very low marginal cost per additional channel. Broadcasters can offer only one "page" (that is, one program) at a time, and must compete with other broadcasters, each of whom is also offering a "page" that usually has similar contents at the same time. Cable operators will be able to deliver 50 or more "pages" simultaneously—provided they can acquire the programming—and will face no direct competitors with equivalent capabilities. Where broadcasters had little choice but to cater primarily to mass audiences, and broadcast advertisers could justify promoting only those products with mass appeal, cable operators can provide highly specialized programming and seek advertising that will apppeal to particular audience segments.

As a result, broadcast franchises are likely to decrease in value; they may lose viewers seeking more specialized entertainment and information. Advertising directed at mass audiences will bring in less revenue as these audiences diffuse. New forms of advertising directed toward specialized consumer segments, already being delivered by cable, will grow, incor-



porating far more details on products and how they are used. Another attraction to advertisers will be the ability to conduct market research at the same time.

Other likely losers in this realignment will be the traditional print media. Although newspapers and magazines have responded flexibly to new competition in the past, and although they have many advantages over electronic media in terms of portability, display quality, and durability, they are quite vulnerable to loss of advertising. This source provides more than 60 percent of the total revenues of most mass-audience print publications. The major newspapers may well remain the superior means for receiving in-depth news, but loss of advertising revenues may force them to raise prices and thus lose readers. This, in turn, may force owners to make major changes in the size, format, content, and even social function of newspapers.

If broadcasters and traditional print media turn out to be the losers, who will be the winners? What new industries will have to arise to support cable TV and allow it to be fully used? This is an area of much controversy, but many of the forces at work are already visible and provide a basis for speculation. Here are a few possibilities:

☐ The great increase in the number of channels will lead to major economic incentives for lower-cost production of high-quality programs. The costs for basic equipment, such as color-TV cameras, have already dropped to a fraction of earlier levels. Prices for associated devices, such as computer-controlled editing and graphics equipment, are following the same trend. Particularly valuable would be the development of large videodisc archives (the "library" of the future?) indexed by content, visual details, and other characteristics. With access through computer, a wealth of quality material would be available.

☐ Because more people will become participants in television as well as spectators, cable will help "democratize" the provision of entertainment and information, much as printing did their availability. Schools and training in program production and performing arts are likely to grow. Some cable systems already offer opportunities for local amateur groups to use community channels and even provide assistance in preparing material. Thus, the programs offered on such channels will gradually become more professional.

☐ Because cable TV is in many ways more analogous to publishing than to film production, successful publishing formats will be applied to the field. Specialized "program-of-the-week clubs" will likely evolve, comparable to book-of-the-month clubs. Owners of videocassette recorders will be able to pick up such programs at their convenience. Packages combining video programs with supporting print materials could be developed. And the video equivalent of indexes and abstracts will be produced. The wealth of material that can be transmitted will tax the effectiveness of printed program schedules; these may have to be replaced by computerized schedules that offer brief samples of programs instead of written abstracts.

☐ The tremendous demand for materials by both audiences and advertisers could lead to a variety of new forms of entertainment and recreation. Even the limited two-way features available on cable systems today are already being used to provide interactive games, and expansion of such activities is limited only by people's creativity.

☐ Video education, whether basic or refresher courses, offers unusual opportunities. At first, cable systems may be used to present and upgrade correspondence-type courses. The next step could involve lectures transmitted to the home, "classroom questions" answered over the telephone, and local facilities established for doing laboratory and practice work. Eventually, fully accredited schools based on such systems could be established.

Business practices and relationships must evolve to support these kinds of services. But there are impediments. The first may be the cable operators themselves, who have complete control over the content of everything they deliver other than programs on community channels and the basic free services. While these operators have financial incentives to use their system's full capacity, restricting usage might increase profits in some situations. For example, if cable-system owners develop some of their own programming, they may seek to limit competition with these products. In many cases, cable operators receive a percentage of program providers' income from advertisers and subscribers. The alternative approach—leasing channels to the providers at specific, time-based rates—is unpopular with operators because they lose control. But the revenue-sharing approach can prompt operators to discriminate against low-fee providers because audiences from higher-fee programs might be diverted.

Numerous other business practices will have to be

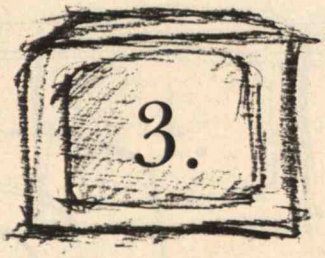
changed or established before cable's potential can be realized. Means of payment for access to video archives will have to be developed. These mechanisms may be more complicated than those for print media. Growing participation in program development may blur the distinction between amateur and professional production, with important implications for stage, film, and television unions. Copyright practices are already a subject of much controversy because photocopiers and videotape recorders have become widely available; it is not yet clear whether the outcomes of these debates will expand or limit the range of programs available on cable.

But the most fundamental long-term regulatory problem relates to the roles of, and competition between, cable operators and the telephone network. Cable systems can deliver a great variety of materials to homes but they have only limited capabilities in the reverse direction. The telephone system, when associated with home computers, offers clear advantages in transaction services such as the ordering of goods or the paying of bills. This capability, already being used, will probably grow rapidly in the next decade. As a result, two very different sets of sophisticated information-related services will soon be available to large numbers of households.

But questions will certainly arise over why it is necessary to have two sets of wires running into households—one a pair of low-capacity copper wires and the other a high-capacity coaxial or glass-fiber cable. The phone service could develop the switching necessary for direct video communications among households, but it won't have adequate incentive to make the necessary investments without the authority to offer video entertainment as well. Cable systems will have the video home-delivery capacity but will lack the switching authority and capability.

Current laws treat cable systems as an overlay on our existing "information infrastructure." And cable-system operators are granted monopoly privileges to induce them to make major investments. But eventually, fundamental changes in the older institutional patterns will be necessary if the full benefits of cable are to be realized. Such conflicts may be difficult to resolve since owners of both the phone and cable systems will have already made massive capital investments.

MARTIN L. ERNST is vice-president and senior staff consultant of Arthur D. Little, Inc.




# The Myth of the Marketplace

BY NICHOLAS JOHNSON

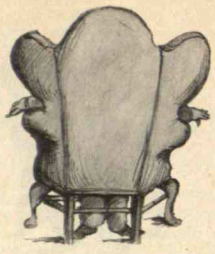
CONSIDER this imaginary conversation:
"Is this the phone company?"
"Yes."
"I'm new in town. Do you have phone lines available?"
"Perhaps. But if we were to put one in, what kinds of things would you be talking about on the phone?"

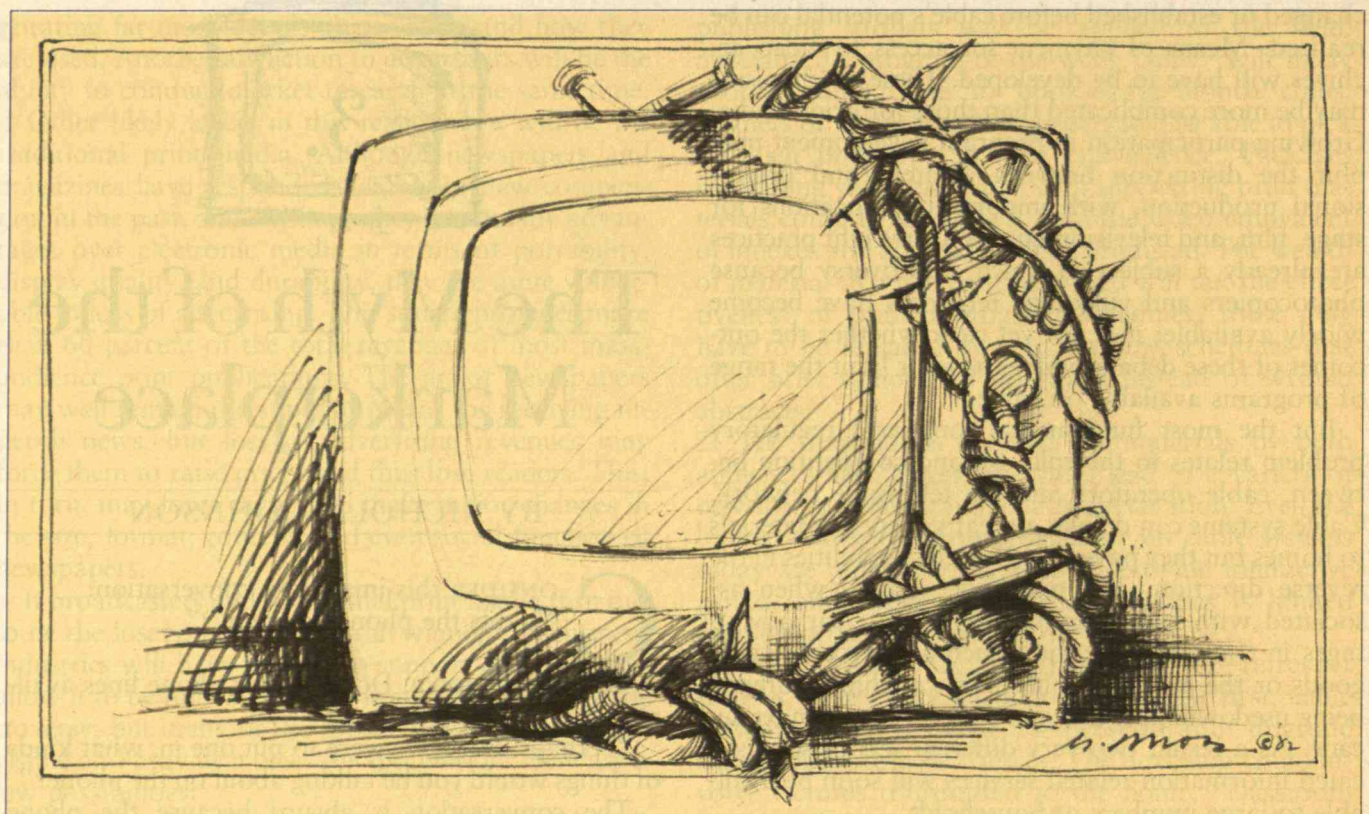
The conversation is absurd because the phone company doesn't control content. At least, not yet. Anyone can get access to the system. Freedom of speech by phone is so fundamental that people can organize protests over telephone rates—and use the phone to do it. Any alternative would be so outrageous we don't even think about it. But the ground rules we take for granted with the telephone are unique among communications networks—and fast eroding.

First Amendment rights have to be rewon with every new communications technology. And right now it looks as though Thomas Jefferson is getting the worst of it.

Consider broadcasting. You have no legally enforceable right to use a local radio or TV station. The station's management *does* ask you, in so many words, "Suppose we were to let you use our radio or television station—what kinds of things would you be talking about over the air?" Individuals have no right to appear if station management would rather censor them; the only exception is candidates for federal office.

Cable television was supposed to change all that. Broadcasting's "economy of scarcity" (with one to





When a company controls all cable channels in a community—TV plus data, banking, and security systems—the potential for abuse becomes alarming.

five stations per community) would become an "economy of abundance," with cable's 12, 20, 35—and now over 100—channels.

What about regulation? According to the cable industry, there was no need: with dozens of empty channels, the "marketplace" would see to it that all people and ideas got access. It would be safe to abandon the FCC's "fairness doctrine" (that controversial issues be covered, and some time provided for a range of views) and other legal guarantees of diversity. And it would not be necessary to limit the number of cable systems one company could own.

These ideas sounded plausible, and many Washington policymakers were persuaded. The volume went up on the rhetoric of cable "deregulation." The only problem was one enormous oversight, one leap of logic. The arguments simply assumed that access to cable was open to all, like access to the telephone network.

But whatever the virtues and vices of "marketplace regulation," one thing is certain: without a marketplace, the rhetoric becomes hollow. At a minimum, a marketplace enables a willing buyer and seller to exchange goods and services for money. That is not possible with today's cable systems. Here's an example:

Ted Turner offers cable subscribers a 24-hour news service called Cable News Network (CNN). He

charges them 15 cents a month. CNN is distributed nationally by communications satellite. Every cable system receives it, but not all use it.

In Iowa City, Hawkeye CableVision has been asked to supply subscribers with CNN, but Hawkeye has stalled for two years. Hawkeye is owned by ATC, headquartered in Denver. And ATC is owned by Time, Inc. in New York. Time, Inc. also owns a pay-cable service called Home Box Office (HBO). HBO is on its Iowa City cable system; CNN is not. Time, Inc. does not own CNN.

Ted Turner wants to sell CNN in Iowa City. Subscribers want to buy. Why is there no sale? Where is the "marketplace"?

Simple—there is no "marketplace." Cable is just not available to entrepreneurs, Hollywood producers, or ordinary citizens if the company doesn't feel like it. (Hawkeye also denied access to a local candidate for county commissioner.) And when a company controls all cable channels in a community (TV plus data, banking, and security systems), the potential for abuse becomes alarming.

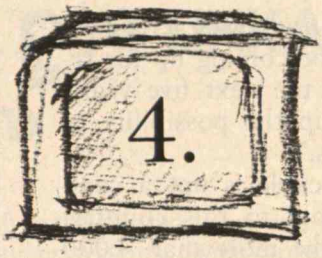
Cable is only the most immediate and dramatic of the censored communications technologies. Similar censorship threats occur with videodiscs, direct-broadcast satellites, videotex and teletext (electronic database services via telephone and television, respectively), and computer conferences.

The issue cannot be ignored, and the answer is seemingly simple: to legally guarantee access and separate distribution and content. Don't let Time, Inc. own both Hawkeye (distribution) and HBO (content). Don't let Comsat own both satellites and network programming. Keep the phone company out of "the knowledge business."

Guarantee the right to buy access to any communications distribution system the way we now guarantee access to the telephone network—for you and me as well as for Ted Turner, Norman Lear, and Mobil Oil. Ensure that the quest for profit drives distribution systems to move as much information as possible rather than choke it off.

If we're actually going to apply the conservative doctrine of regulation by the marketplace, not just use it as a fraudulent cover for unrestrained greed, "access" is an idea whose time has come.

NICHOLAS JOHNSON was Federal Communications Commissioner from 1966 to 1973. He is now a lecturer and writer, teaching cable policy at the University of Iowa, and a member of the Iowa City cable commission.




# Cities as Operators

BY PAMELA VARLEY

DESPITE a history of contentious relations between city officials and private cable operators, most people assumed—until recently—that cable would remain largely a private enterprise. But several major cities, frustrated by what they see as the intransigence of the cable industry, are now seriously thinking of operating their own systems.

So far, the biggest public debate over municipal ownership has taken place in St. Paul, Minn., where a proposal to institute a city-run cable system appeared on the ballot last April. The stakes were high enough for the "pro" and "con" sides to spend a total of nearly half a million dollars on the campaign. "Citizens for Risk-Free Cable," the industry-backed opponents of municipal cable, outspent the "Yes Public Cable" effort by 2 to 1. Insisting that a private cable system could be in place much sooner than a public one without straining the city treasury, and playing up the theme of general government ineptitude—in the spirit of "how can you expect the city to take care of cable if it can't take care of the garbage?"—the anti's won by a decisive margin. "It was the first time the industry brought out all its guns," says Susan McAdams, director of the Telecommunications Project of the National League of Cities.

The cable industry is nervous about the municipal cable issue, not only because several other cities—including Cleveland, Palo Alto, and Cambridge, Mass.—are thinking of starting their own cable systems, but because more than a third of the existing

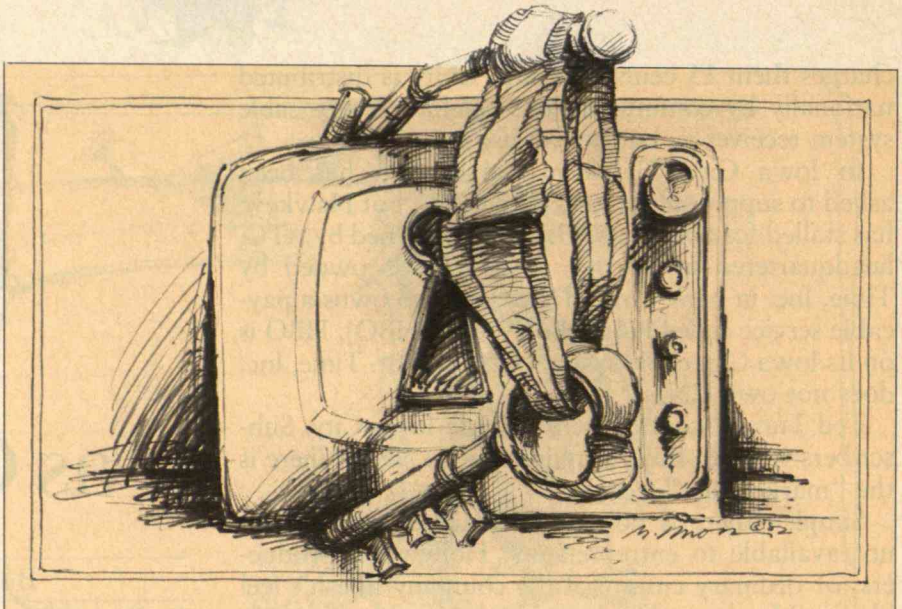
private cable franchises across the country will be coming up for renewal within the next five years. That opens up the possibility of city "buy-outs."

Municipal cable is not a complete newcomer to this country. Some 40 of the more than 4,000 cable systems currently operating in the United States are city owned and operated. Most were built in the 1950s and 1960s to service communities such as Opp, Ala., and Cawker City, Kans., which were too small to lure private cable companies. (The largest municipally owned system is in San Bruno, Calif., with a population of 35,000.)

But in recent years, larger cities began to investigate municipal cable. Because the industry was becoming deregulated, cities could demand less and less from a company in return for granting it a cable franchise. In 1979, for instance, the Supreme Court struck down a Federal Communications Commission regulation requiring any private operator with more than 3,500 subscribers to provide one to four channels for public-access programming. In addition, the FCC has limited the amount a city can tax a cable firm through franchise fees.

During the 1970s, local governments also began to complain that cable companies often failed to meet the timetables and commitments of their bid proposals. In Atlanta, for instance, one company was granted a cable TV franchise but never developed it. According to David Zaccaria, Atlanta's cable communications coordinator, the city gave up after five years of waiting. In Tucson, cable officials report that construction of its private system is running substantially behind schedule, and that the promised "interactive," or two-way, service has been "delayed indefinitely due to technical difficulties." Other cities have reported faltering in the area of public access.

For their part, of course, representatives of the cable industry argue that city officials have placed wildly unreasonable demands on private operators.



**Advocates of municipally-owned cable argue that cities, not aiming simply to maximize profits, could provide more to the community, but industry representatives contend it is dangerous for government to own an arm of the media.**

In addition, the industry has advanced several major arguments against municipal ownership. First of all, say industry representatives, such a move is an unjustifiable intrusion into free enterprise. Cable is a luxury, not a necessity, they insist, and cities should no more consider taking over cable television than they would think of getting into the restaurant business.

City officials counter that cable is different from other private enterprises because it has the potential to be an important city utility, not merely a luxury service. For instance, a report from a study committee in Cambridge emphasizes the social-service potential of cable—as the "library of the future," as the link between universities and their surrounding communities, as a widely accessible educational tool, and as a way to involve more people in the political process. Cambridge Cable Commissioner Joseph Sakey envisions an interactive system that would, for example, permit bedridden schoolchildren to "attend" their classes by TV. He also believes cable will help draw more chronically isolated people—such as

the elderly and immigrants who speak little English—into the community. "I see a lot of personal interaction with cable that would otherwise not exist," he says. "I see cable becoming as important to homes as the telephone."

Industry representatives question whether the public is really interested in all the services, educational programs, and public-access shows the cities have in mind. According to James Hedlund, vice-president of the National Cable TV Association, the number of viewers for much of the existing public-access programming is "horrible." And besides, he says, "I have a real fear of government deciding what people should watch."

Advocates of municipal cable argue that cities, because they will not aim simply to maximize profits, could provide much more to the community than the money-making staples of commercial cable—largely movies and sports. And they insist that cities would offer such expanded services at lower rates. At the same time, they suggest, cable might serve as a creative way for fiscally beleaguered municipalities to raise money.

But industry representatives contend that the profit margin of cable is not nearly wide enough for more services, reduced rates, and extra municipal funds. Furthermore, they argue, it is absurd for local governments to finance the construction of super-deluxe systems at a time when most are having to cut back on critical services. Indeed, industry representatives contend that cable television is a risky venture. "There's an incredible misconception that cable is a golden goose," says Hedlund.

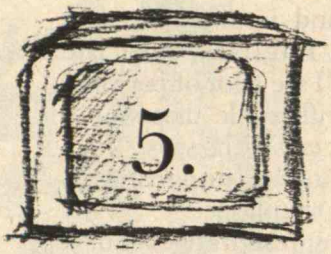
Advocates of municipal ownership tend to dismiss the "risk" idea. After all, they ask, how many cable bankruptcies do you see? David Thomas, director of San Bruno's cable system, reports that the city's annual profit from cable is 25 to 30 percent of gross revenues, and that the system offers consumers lower rates than those of surrounding communities. But Stephen Effros, director of the Community TV Antenna Association, a group representing small cable operators, says that many small systems are having financial difficulties: "Most cable companies don't go under the way you think. Before a big failure happens, you get out. You sell."

Another argument against municipal ownership—perhaps the industry's strongest card—is the First Amendment issue. It is very dangerous for government to own an arm of the media, industry representatives contend. Private firms have themselves been accused of censorship, but that issue looms more insidious with a city government at the helm. Would anyone seriously consider allowing New York City to buy and operate the *New York Times*? they ask. And they point out that a city acts as a watchdog over a private cable company, but if the city runs its own system it becomes prosecutor, judge, and jury.

Advocates of municipal cable concede that this is a potential problem with a government-run cable system, but they counter that cable companies are exaggerating the issue for self-serving reasons. After all, the British Broadcasting Corporation is public, they say, but is it criticized for censorship? Nevertheless, Cambridge has considered establishing a separate entity, buffered from city government, to operate its system, even though many industry representatives scoff at this safeguard. "I don't care what form of management the city sets up to run it," says Paul Cinnelli, director of the New England Cable TV Association, "they are going to have influence and control over it."

Because the controversy over municipal ownership of cable is relatively new, such ventures are sailing in largely uncharted legal waters, and the issue will likely wind up in the courts. But some cities may well conclude that municipal ownership is not worth that kind of struggle. "The industry has a litigious record," says McAdams, "and cities don't have the resources to fight protracted legal battles."

PAMELA VARLEY, a reporter for the *Cambridge Chronicle*, has covered, among other things, cable television and municipal politics.




# The Wiring of Britain

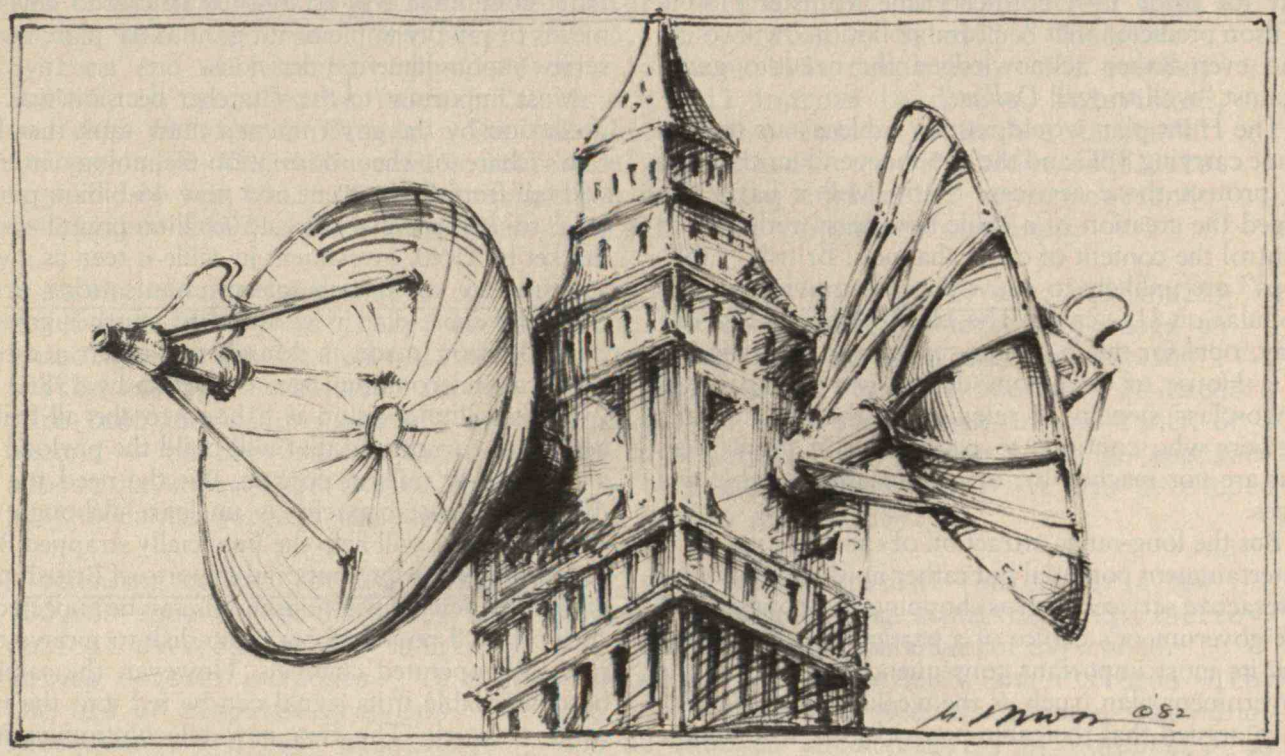
BY STEVEN L. SOLNICK

NOBODY knew quite what to expect when the government announced "IT '82," Britain's Information Technology Year. Over a million pounds were earmarked to raise public awareness of information technologies—everything from computers to robots—and to generate enthusiasm within British industry for manufacturing new electronics products. Kenneth Baker, Member of Parliament, was named minister of state for information technology, probably the first post of its kind anywhere.

IT '82 remained a rather low-key affair—its blue-dotted "i" did not become an instantly recognizable symbol. In fact, IT'82 would probably have come and gone with little legacy beyond two postage stamps if it had not been for government actions last March that seemed to turn the year of information technology into the year of communications technology.

First, the Thatcher government endorsed a report from its special Information Technology Advisory Panel (ITAP), which recommended that Great Britain proceed "urgently" to adopt a network for cable television. A subsequent three-person panel headed by Lord Hunt gave this plan the go-ahead in October, proposing that regulation be minimal and cable franchises limited to small areas. The cable plan became part of the government's 1983 legislative program, proposed in November.

This decision, made with uncharacteristic haste, may have far-reaching effects; it has already generated considerable controversy. Only about 1.5 million homes currently receive cable in Britain, a coun-

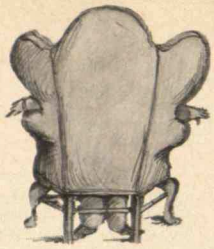


Investment in cable is seen as a way to stimulate all British telecommunications firms.

try in which 99 percent of all viewers receive two nationalized channels (both owned by the British Broadcasting Corp.) and two independent channels without difficulty. Why the haste with cable?

The ITAP report accurately described present cable systems as obsolete, having capacity for only four channels. According to ITAP and Hunt, cable systems will provide the capacity for the "teleservices" of the future—shopping, banking, computer information services, and so on; Britain must be wired or miss the technological boat. More important to the Thatcher government, which faces elections by 1984, the wiring of Britain will generate at least 2,000 new construction jobs, save 5,000 existing jobs in electronics industries, and generate over 2.5 billion pounds of private investment (the estimated cost of cabling half the British populace). IT Minister Baker predicts that the cabling of Britain could actually stimulate an investment flow of 20 billion pounds over the next decade. And although this exact figure is disputed, none of this investment would cost the government a half-penny.

However, the cable revolution will cost the government a measure of its historically tight control over broadcasting in Britain. All British broadcasters are strictly licensed; to trigger the flow of private investment, this policy would have to be eased. A new cable network would have to offer a large number of different channels and services to be a success, much the way American cable services must offer dozens of channels to be competitive. Many fear that this deregulation will threaten the high standards of the BBC, which is largely funded from a steep television license fee paid by all TV owners (46 pounds annu-



ally for color TV). Former Prime Minister Harold Wilson predicted that "cultural pollution" will result, and even Baker acknowledged the need to guard against "wall-to-wall *Dallas*."

The Hunt plan would require cablecasters to continue carrying BBC and the two independent channels to protect those services. Many M.P.'s have also urged the creation of a cable broadcast authority to control the content of cable channels: British "cable-cops" are unlikely to allow the blue-movie channels popular on U.S. cable. The Hunt plan, to their dismay, opts for much lighter supervision. Participants in a House of Commons debate warned against a "two-class system of television" that could hurt viewers who continue to pay television license fees but are not reached by, or cannot afford, cable services.

But the long-range attraction of cable lies not in its entertainment potential but rather in its capability for interactive services such as shopping and voting. Here the government's choice of a particular cable system has its most important consequences. Critics of the government plan (such as the weekly *New Scientist*) have argued that the cable network that will emerge from the Hunt plan will not be adequate to meet the demands of a decentralized "telesociety." They urge the government to embrace an all-optical-fiber network, perhaps building on British Telecom's extensive optical-fiber system. Optical fibers offer much greater bandwidth (or frequency spread) than conventional, cheaper coaxial cables, thus allowing much information to be received simultaneously. The critics further argue that the Hunt plan ignores Britain's chance to bypass coaxial systems, such as those currently popular in America, and accommodate the much higher fidelity television and high-data teleservices possible with fiber. The greater capacity could also open the door for high-definition television, digital stereo sound, and rapid data transmission useful for home computers and video games alike.

Some newspapers and magazines have urged the government to experiment with different systems rather than to hastily adopt one plan or to permit a haphazard franchise-by-franchise patchwork to develop. They point out that that the ITAP conducted no market surveys of what British viewers actually want from cable service, nor did it consult unions or consumer panels. The ITAP itself consisted almost entirely of representatives from industries with the most to gain from the rapid wiring of Britain. The Hunt committee was established strictly to devise a means of rapidly implementing the ITAP plan, not to review its fundamental decisions.

Most important to the Thatcher decision was the prediction by the government's think tank that Britain's share of the information-technology market will fall from 3.8 percent of a now 46-billion-pound total to 2.4 percent of a 150-billion-pound world market by 1990. Investment in cable is seen as a way to stimulate all British telecommunications firms. Also, the cable plan is essential to another government decision made in March to launch a direct-broadcast telecommunications satellite by 1986.

The satellite decision is a boon to the all-British aerospace consortium that will build the payload for a price of 40 million pounds. But the need for the direct-broadcast capacity is unclear: although the satellite service will help the financially strapped BBC and could boost international exports of British programming, few British households can be expected to shell out 500 pounds for a radio dish to receive two new BBC-operated channels. However, the satellite becomes viable if its signal can be fed into the new cable network. The two new telecommunications plans thus become mutually supportive, although the weekly *Economist* called the satellite-to-cable scheme analogous to "buying a Rolls-Royce to ride to the bus stop."

The cable revolution, with its satellite skirmish, seems destined to have a great impact on how Britons watch television, bank, shop, and even read their beloved newspapers in the future. If accomplished, it will set a precedent for easing the restrictive regulations on the British broadcasting community. And most important for the Conservative government, it will provide a rare opportunity to create jobs, help the British high-tech industry, and entertain voters with a new technological toy—all before the campaigning starts and without government expenditure.

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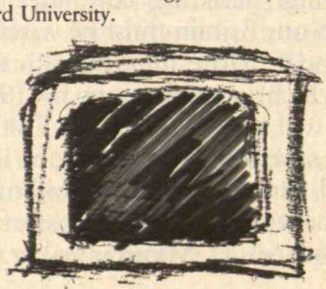
STEVEN L. SOLNICK, former editor-in-chief of M.I.T.'s *The Tech* and a frequent contributor to *Technology Review*, is currently a Marshall Scholar at Oxford University.



# SCIENCE/SCOPE

Two communications satellites made history as the first to be launched from NASA's space shuttle. The first, SBS-3, is operated by Satellite Business Systems and will carry high-speed data for many U.S. companies. The second, Anik-C, is operated by Telesat Canada and will improve telephone, television, and data service in Canada. The satellites are versions of Hughes Aircraft Company's HS 376, the world's most widely purchased communications satellite. Hughes now has built 70% of the world's operating commercial communications satellites and has more successes than all other companies combined.

A safety device that snuffs out explosions in the blink of an eye, originally developed for the military, is being applied commercially where fire poses an immediate threat to human life. The Dual Spectrum™ sensing and suppression system has been evaluated in New York Transit Authority toll booths. It detects fire bomb explosions set off by criminals, and suppresses them in one-tenth of a second -- before transit employees can be injured. The system could be applied almost anywhere fire explosions occur within an enclosed area. It was developed by the Santa Barbara Research Center, a Hughes subsidiary.

A computer center for improving productivity is one special feature of a new 500,000-square-foot facility at Hughes for manufacturing sophisticated electro-optical devices for the military. The computer-aided manufacturing center serves several purposes. It allows engineers to design tools and fixtures with the aid of computer graphics. It also lets them write specifications, planning procedures, and test procedures -- and be checked automatically by computer. By gathering data from automatic test equipment, the center gives engineers insight into every facet of manufacturing, including production rates and quality.

Five new IMPATT diodes, with the highest power outputs at their respective frequencies offered to date, have been added to the Hughes line of solid-state millimeter-wave transmitter products. Included among the devices are Ka-band and Q-band units with output power of 500 milliwatts and a V-band CW device of 400 milliwatts. In addition, 140 GHz IMPATTs, with 20 milliwatts output in the CW version and 1 watt in the pulsed version, have been added, marking the first time that IMPATT diodes at D-band have been offered in a sealed packaged.

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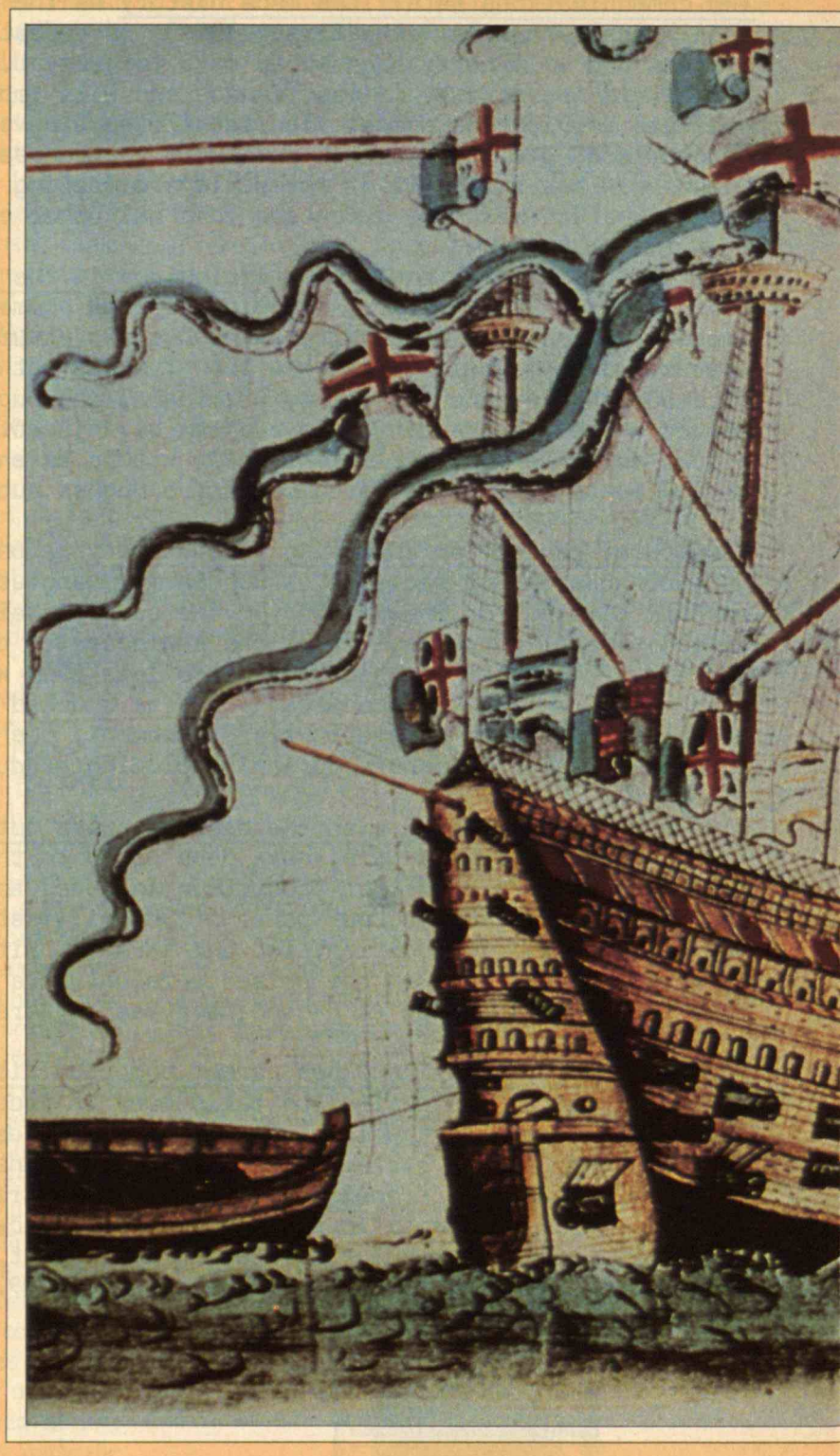
# Search for the *Mary Rose*

BY HAROLD E. EDGERTON



*The Mary Rose, pride of Henry VIII and the first true warship, sank in 1545 without a shot being fired. Her "discovery," using modern sonar surveying equipment, marked a turning point in marine archaeology.*

On July 19, 1545, the British navy sailed out of Portsmouth harbor on England's southern coast to repel a French invasion. Prominent was the warship *Mary Rose*, pride of King Henry VIII and vice-flagship of his royal fleet. She carried 91 guns and a crew of 700, far exceeding her normal crew of 415—a load so great that the ship had barely a foot of freeboard between the water and her gun ports.

As the king watched from Southsea Castle, four French galleys approached to open fire on the *Mary Rose*. But before any shots were exchanged, the ship heeled sharply to starboard. Seawater rushed in the open gun ports and she sank. There were fewer than three dozen survivors.

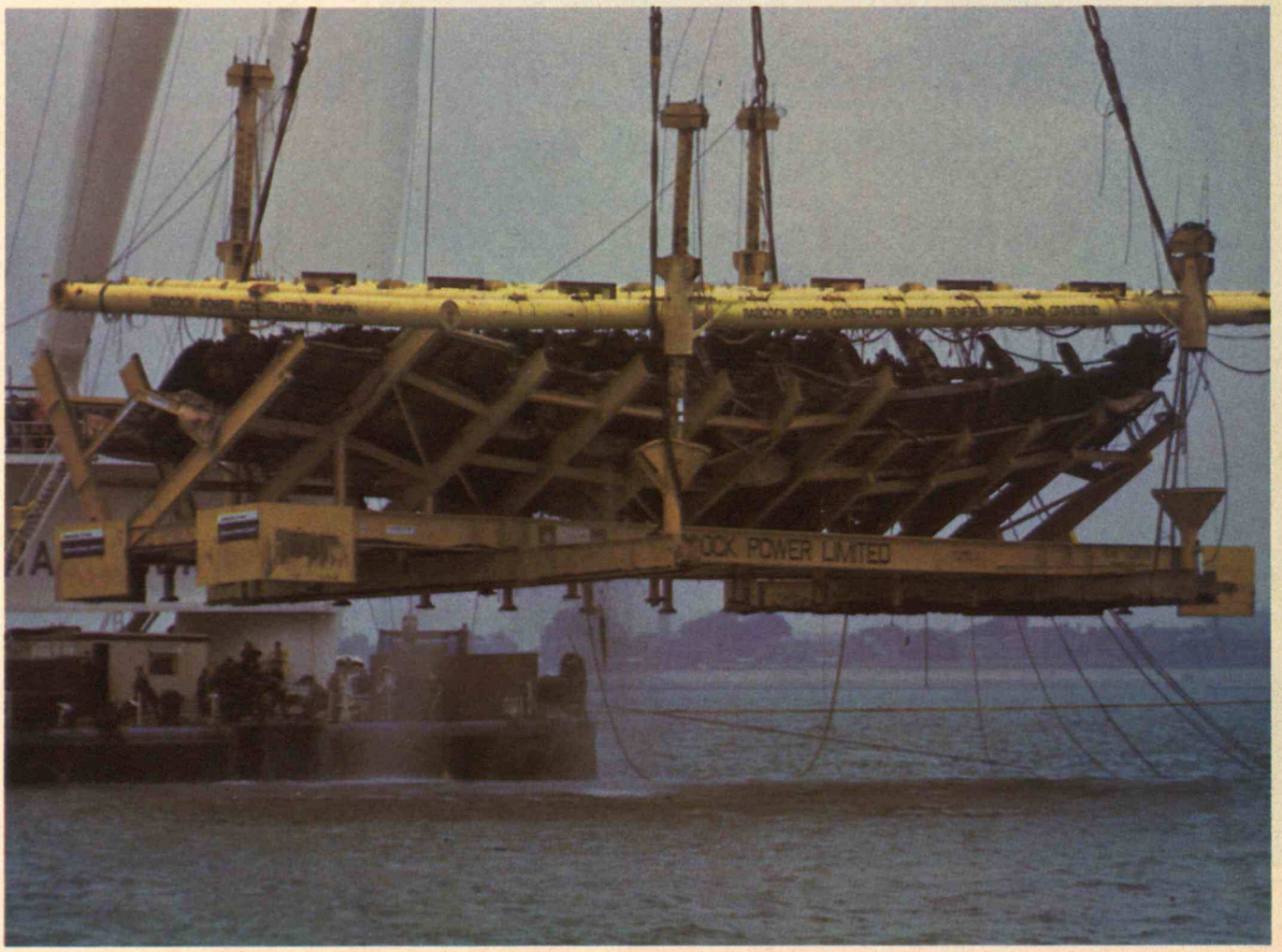
No one knows quite what happened, though her top-heavy load and the crew's reported poor discipline probably contributed. According to one notable eyewitness, the ship began to heel as soon as the crew hoisted the sails in preparation to fight. This prompted Sir George Carew, her vice-admiral, to shout, "I have the sort of knaves I cannot rule." Ironically, the sea battle never materialized: unable to slip past the British ships, the French quietly returned home.

Since the *Mary Rose* sank in only about 40 feet of water, the tops of her masts could still be seen. King Henry ordered salvage operations to begin immediately. One scheme involved using "tidal power." An empty ship was moored on each side of the *Mary Rose* and ropes from each ship were attached firmly to the wreck. The plan was that the ropes would be hauled tight at low tide, and as the tide rose, the buoyancy of the two floating ships would lift her up. But the operation failed, possibly because of her great weight, as did other attempts to drag the ship "as she lyeth" into shallow water. The *Mary Rose* was gradually forgotten.

In 1836 John and Charles Deane of Kent, salvage operators and "underwater engineers" who had invented the first practical diving helmet, stumbled upon the wreck while clearing obstructions for local fishermen. Over the next four years they brought up numerous guns, timbers, and other material, carefully recording the results of their work in drawings. They then abandoned the site, and the shifting seabed apparently covered the *Mary Rose*. It was left to modern searchers to "rediscover" the wreck in the 1960s.

### The Modern Search Begins

Alexander McKee, a self-trained military



*Stern down and heeled to starboard, exactly as she had hit bottom, the Mary Rose had not moved in 430 years.*

historian, and Margaret Rule, a Portsmouth archaeologist, were confident that the muddy bottom of the Solent—the channel between the Isle of Wight and Portsmouth where the *Mary Rose* sank—would have had a powerful preserving effect despite the active tides. (Unless a ship becomes buried, currents and wood-eating worms soon destroy its remains.) McKee, who was also a diver, enlisted colleagues in the Southsea Sub-Aqua Club and began exploring the area in 1965.

They soon found and surveyed two eighteenth-century wrecks, confirming that sunken vessels could indeed survive the currents, and McKee turned to researching historic accounts of the *Mary Rose*. In 1966, with hard work and luck, he found a naval chart from 1841 with a red cross marking the spot where the Deane brothers had discovered the *Mary Rose*.

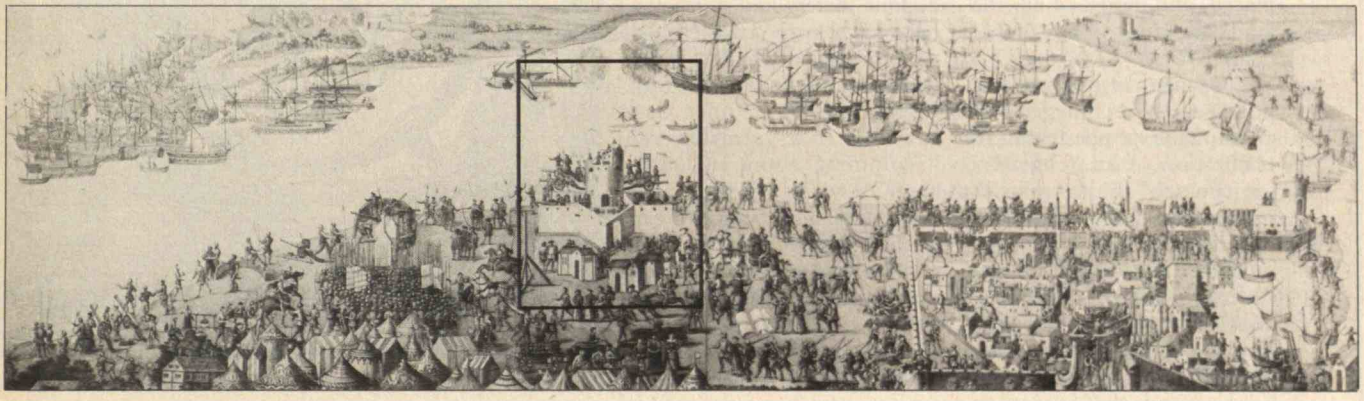
Underwater inspection of the area showed that the sea bottom was covered with soft, light silt, perfect for preserving an entombed ship. McKee also found a shallow depression, suggesting that something might be buried there, but it was clear that visual searches and even probing would be inconclusive and time consuming. The searchers decided to seek help, and this is where I had a chance to participate.

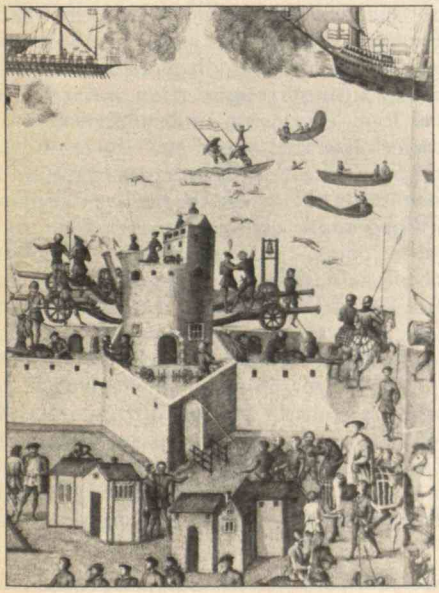
At the time, John Mills, a former student of mine, was employed as a technical representative for EG&G, a company I had helped form to develop and produce electronic equipment for underwater surveying. He had gone to England to promote a demonstration model of one of the company's early side-scan sonar devices. There he met McKee, who was anxious to end his groping in the dark, and Mills was soon enlisted to help conduct an electronic survey of the area.

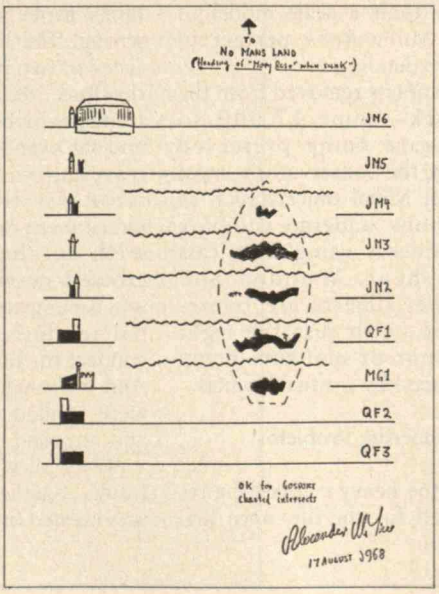
### Electronic Searches

Despite some difficulties, the two used the side-scan device to obtain sonar records showing several suggestive features on the bottom, including a detailed "picture" of the depression McKee had found earlier. However, the side-scan sonar system can detect features only on or protruding from the seabed—so the evidence was stronger but still inconclusive. What was needed was a system that could electronically explore the sediments.

Fortunately, I had recently developed just such a device, called a "mud penetrator." It operates by sending sonar








**King Henry looks on (lower right of insert) as the *Mary Rose* sinks in front of the French fleet. In the eighteenth-century engraving, only her masts are visible.**

**In 1965, Alexander McKee began searching for the wreck, and his drawing of the "discovery" is shown at left. The drawing represents subbottom sonar records made during passes over the site; each pass was aligned with a building on land. Sending this drawing to Harold E. Edgerton, who developed the equipment, McKee called this "the first electronic trenching survey of a submud historic wreck."**

**Far left, the hull emerges on October 11, 1982, culminating the most ambitious marine archaeological operation ever.**

**Photographs and drawings in this article courtesy of: The Mary Rose Trust; Magdalene College, Cambridge; Wide World Photos; and Harold E. Edgerton.**

# *Mary Rose*: The Technology Behind the Lift

by John Stansell

ALTHOUGH the *Mary Rose* is now safe in her new home in Portsmouth dockyard, her raising was a close call. So close, in fact, that it prompted one reader of Britain's *Financial Times* to write, "Foreigners must continue to be astounded at [Britain's] propensity for depicting a series of errors as a matter for congratulations."

As this correspondent noted, the "locking pins" used in the lifting gear were half the size called for in the design. Only because of an army engineer's insistence were three of these small pins used on each leg instead of the two specified. The lifting slings were incorrectly placed, and, worst of all, the load calculations were "hopelessly wrong."

Yet when the hull was deposited on its barge, the champagne popped was in celebration of an "engineering triumph" rather than in relief. This despite considerable delays that could not be attributed to the weather, despite the fact that only the "extra" locking pin saved Henry VIII's ship from being crushed when a lifting sling broke, and the fact that somehow (nobody has yet come clean about it) one leg of the lifting frame bent.

### Flawed but Bold

If you try to piece together what happened, you are merely told that the ship is safe and, because there won't be other lifts like this, that nothing can be gained by such questions. The operation was undoubtedly unique. And even the mistakes shouldn't conceal the boldness of the scheme or the fact that new technologies were applied intelligently.

For example, the search for the wreck and its painstaking identification could not have been done without subbottom sonar systems. The divers who removed the mud from around the hull at the beginning of every excavation season, and put it back at the end for protection from the currents, used specially designed suction devices. And the positions of major features such as deck beams and frames were "fixed" with great precision using an acoustic rangemeter.

Undersea television cameras were often used to peer through the murky waters during the long process of surveying the wreck. Visibility was rarely as good as four meters and normally between one and three meters. Prince Charles, who had made numerous dives to inspect the ship, once described it as similar to "swimming about in lentil soup." A secret 3-D television camera, being developed by a leading British defense contractor, was even used on one occasion. The quality of these observations was such that Margaret Rule, the archaeologist directing the project, said her team could have built a scale model of the *Mary Rose* perfect in every detail.

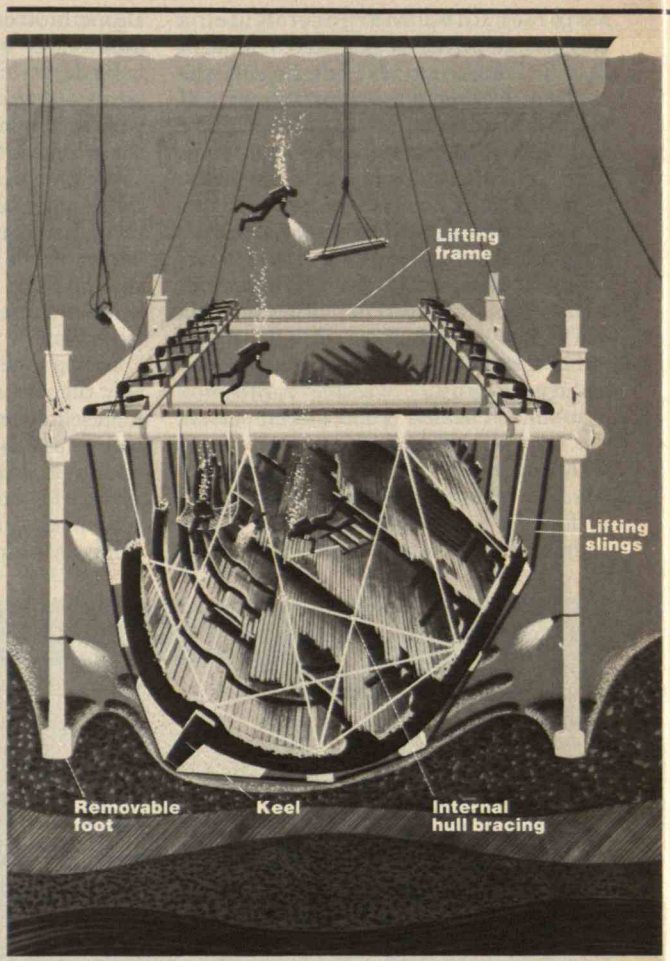
Artifacts removed from the wreck—some 17,000 so far—are being preserved using the conservator's latest skills. Metal objects such as cannons undergo complex treatments using chemicals and heat. Wooden and leather objects are freeze-dried, with just the right amount of moisture being replaced by artificial waxes.

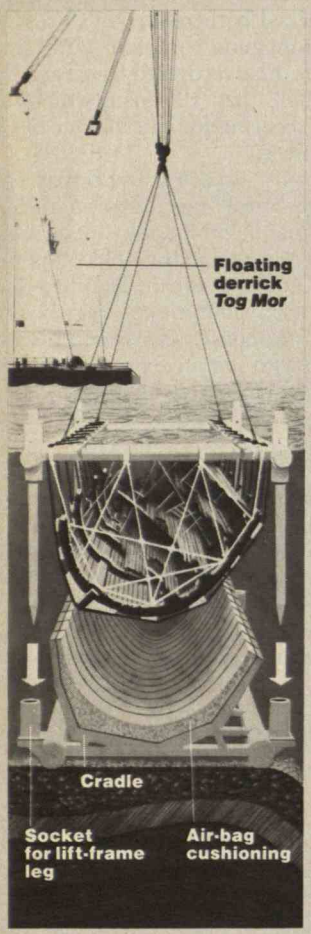
### Engineering Problems

But the heavy engineering required for the lift, once Britain's forte, was what went wrong. The lifting gear consisted of two parts. First came the huge rectangular lifting frame, which had four legs and sat over the wreck like a traveling yacht hoist. The strongest timbers in the wreck were drilled and fitted with eye-bolts. A criss-crossed network of cables was strung to provide internal reinforcement, and to connect the hull to the frame. And wide nylon lifting slings were snaked under the hull and attached to the frame.

When all was secured, the frame, together with the hull, was hoisted off the bottom by the *Tog Mor*, a towering floating derrick borrowed from the North Sea oil fields. It was then moved sideways—still underwater—and lowered onto the second part of the lifting gear, the cradle, where the hull was cushioned by airbags.

The legs of the lifting frame were designed to fit into sockets in the cradle. The two parts would be linked firmly—in theory—by locking pins through each leg. The *Tog Mor* would then haul up the combination and transfer it to a barge. But just as the *Mary Rose* cleared the surface, a lifting sling broke






**Close call. The hull is hooked to the frame by cables and slings, ready for transfer to the cradle. During the final lift, a sling broke, dropping part of the frame onto the hull.**

**Luckily, damage was minor. (Reprinted from *Popular Mechanics*, November 1982, © The Hearst Corporation, all rights reserved. Illustrator: Dean Ellis.)**

and the weight shift sheared two of the locking pins in one leg. Part of the lifting frame dropped onto the fragile timbers, but the third pin held and damage was minor. Said Prince Charles later: "I was slightly horrified, but I thought the best thing was to be British and not panic."

After the frame was repaired, the hull was maneuvered aboard the waiting barge. Wrapped in plastic and sprayed with seawater to inhibit further decay, the *Mary Rose* was soon on her way to Portsmouth harbor, culminating the most ambitious—and at $7 million the most expensive—underwater archaeological operation ever.

### Location by Sound

One piece of technology that did perform well was an acoustic guidance system made by Sonardyne in Fleet, Hampshire. The firm's engineers used two pairs of underwater transponders, all containing microprocessors, to calibrate the exact location of the wreck and the cradle. During the lift, the transponders monitored the bearing, distance, and height of the lifting frame in relation to the cradle. The data were relayed to a computer onboard the support ship, and were displayed visually to help guide the operation.

On the first attempt to dock the frame, the transponders indicated that the two parts were joined correctly—yet the frame was clearly skewed. Divers went down to see why and discovered that one leg was bent. Cables were used to replace the damaged leg, delaying the lift by a day. The final operation was done relying on one pair of transponders, with divers keeping close watch.

A final footnote: just as the hull cleared the water—and just before the locking pins sheared and the frame collapsed—the Prince of Wales was invited to climb onto the wreck. He declined. Had he not, the engineering errors might now be under urgent investigation rather than being passed off as irrelevant. □

JOHN STANSELL is editor of *Technology Investor*, a London-based newsletter and sister publication of *New Scientist*.

pulses down into the seabed and recording the echos produced by the various sediment layers and whatever they hide. The key is using the proper frequency for the pulses—about 6,000 cycles per second. Higher frequencies, used in depth recorders, do not penetrate the sediments. Much lower frequencies penetrate but lack good image resolution; low-frequency devices are widely used in geologic exploration. The "sonagrams" are displayed by a graphic recorder as cross-sectional images of the seabed.

In the summer of 1968, John Mills and I employed this subbottom sonar system in a search for another ship in Scotland, the Duke of Argyle's Tobermory Bay wreck. I then took the equipment to the Solent, where McKee and Margaret Rule put it to work. McKee painstakingly analyzed the resulting sonagrams and reported his results to me in a letter dated August 17.

He had been able to eliminate as not being the *Mary Rose* every feature recorded, except for the one at the site marked on the 1841 chart. The sonagrams, McKee wrote, showed this to be "an oval-shaped feature about 200 feet long headed towards No Man's Land [out to sea]." It was "smaller at the ends than in the middle . . . Oh, ho!" And he stated his belief in "the hypothesis that it results from the insertion into the seabed of 700 tons of battleship . . . . If the suspect feature proves indeed to be the *Mary Rose*, then I expect we shall be able to claim the carrying out of the first electronic trenching survey of a sub-mud historic wreck."

Still, events moved slowly. For the next two years, divers used water jets to cut through the sediments, eventually bringing up a cannon and an oak plank. These convinced remaining skeptics that here indeed was the resting place of the *Mary Rose* and this use of sonar survey equipment was a major achievement in the fledgling field of marine archaeology. The ensuing publicity also brought badly needed money and equipment to the project.

Work on the site continued, mostly by a small team of volunteer divers who devoted weekends whenever tidal and weather conditions allowed, and early in 1971 the wreck was revealed. Excavation showed that the ship actually lay with her bow heading toward the harbor entrance, not out to sea as McKee had first imagined. Stern down and heeled to starboard,

exactly as she had hit bottom, the vessel had not moved in 430 years. The upper side (port) had been eroded by currents, but the underside (starboard) was found to be well-preserved to almost its full height at the stern. And excavations inside the ship revealed that most of her stores were still littered about the decks.

In 1979, after meetings that involved archaeologists and ship historians, structural engineers and salvage contractors, the decision was made to recover the ship. The Mary Rose Trust, a registered charity, was formally inaugurated, and His Royal Highness the Prince of Wales agreed to be its president. Finally, after extensive preparation, the *Mary Rose* was raised on October 11, 1982.

### Tudor Time Capsule

Researchers have already learned much from the *Mary Rose*, and they will find out more now that they can study her closely. "No ship of this importance has ever been found before," says Richard Harrison, director of the Mary Rose Trust. Her construction marked a unique point in the history of naval architecture. Henry VIII ordered the ship built in 1509 as part of a vigorous program to bolster his navy. The *Mary Rose* was to be the first true warship, not just the usual converted merchant vessel.

The ship's hull was smooth, made of planks nailed edge-to-edge. This differed from the customary "clinker" construction in which planks overlapped. The new design permitted the use of lidded gun ports below decks, ideal for the placement of heavy armament. Also, the stern was

**Harold "Doc" Edgerton, developer of the subbottom sonar system used to pinpoint the ship's location.**

"squared off" to accommodate more heavy guns, replacing the rounded-stern design of earlier ships.

Equipped with an array of "modern" weapons—"cannons, demi-cannons, culverins, and sakers"—the *Mary Rose* revolutionized fighting at sea. Enemy ships were first engaged with long-range broadsides before closing in for the traditional combat with light guns and archers. Those who knew defeat at her hands were many, and the ship's capabilities, until that fateful July day, seemed to ensure that England would maintain control of her waters.

Fittingly, the *Mary Rose* will be displayed in Portsmouth, where she was built. Restoration and conservation efforts will continue for at least several years. The hope is that she will bring to the public's eye an appreciation of the Tudor lifestyle. Thus, the ship's contents are as important as the wreck itself.

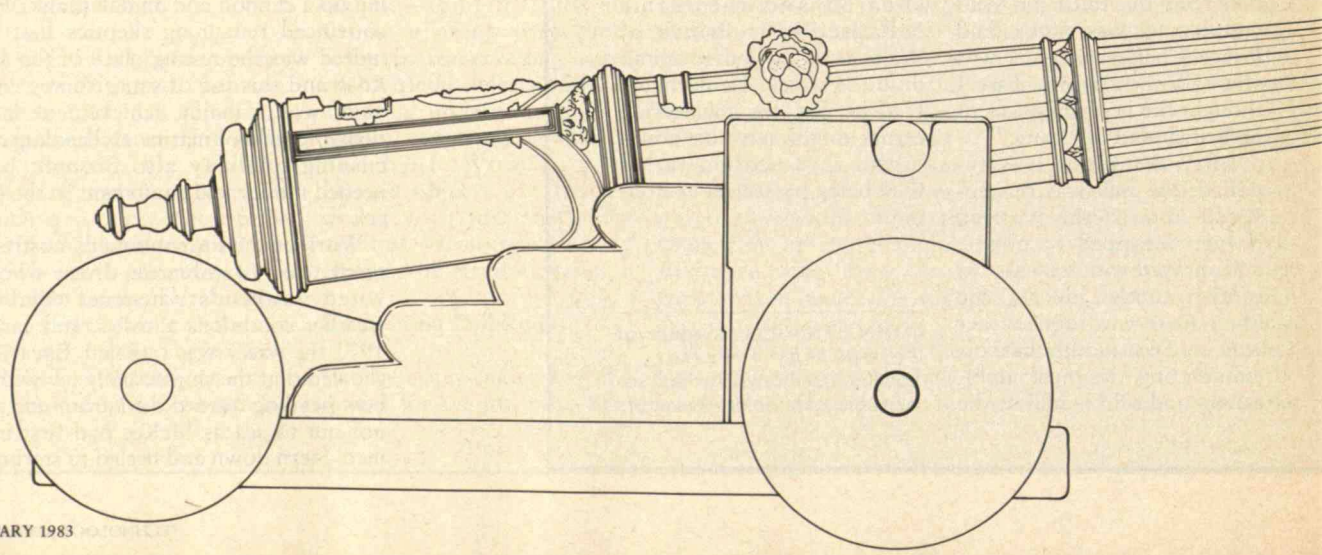
Some 17,000 artifacts have already been recovered during excavation, many proving to be rare examples of the period. The artifacts range from fine pewter flagons to thousands of menacing arrows, from a stocked barber-surgeon's chest to wrought-iron guns complete with shot and powder. Also recovered have been the bones of more than 100 men, which scientists are studying for clues about nutrition and disease.

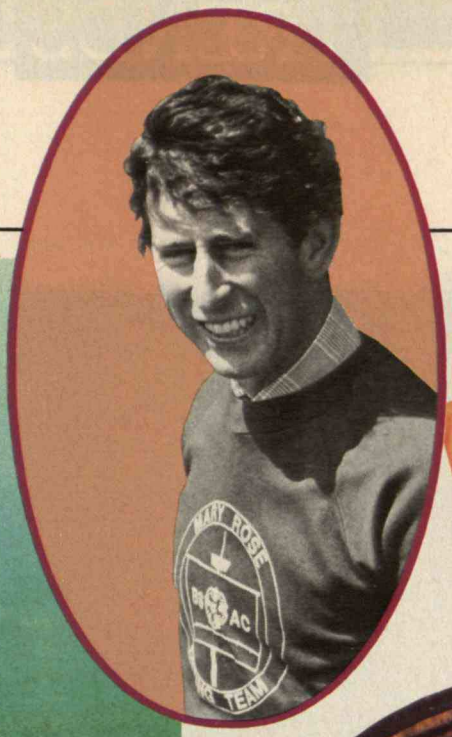
One mystery already solved involves a "square murderer," mentioned in a 1628 ordnance manual. Nobody knew what such a device was until one turned up on the *Mary Rose*—a square-mouthed gun that fired a spray of iron shot. Possibly the oldest English ship's compass was discovered, along with primitive protractors and dividers, suggesting that maritime charts were more widely used at that time than believed.

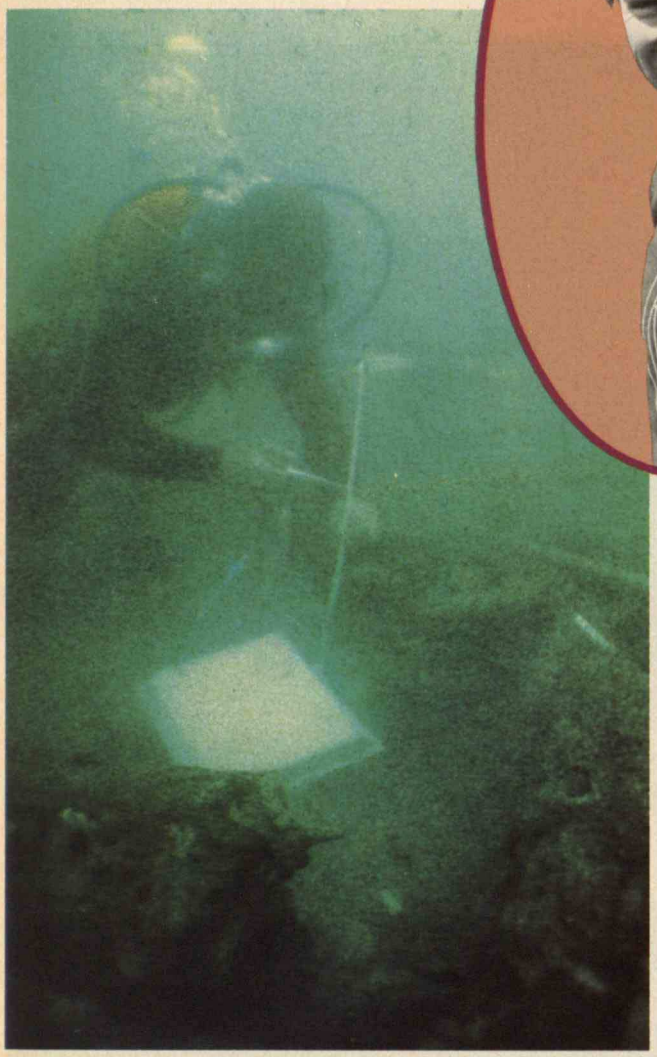
Each artifact's location on the wreck has been carefully recorded, since its position can be as informative as the item itself. And every artifact has been assiduously washed, photographed, drawn, cataloged, and preserved. Once the hull is mounted for exhibition, in the same cradle used when it was raised, numerous artifacts will be returned to their original location.

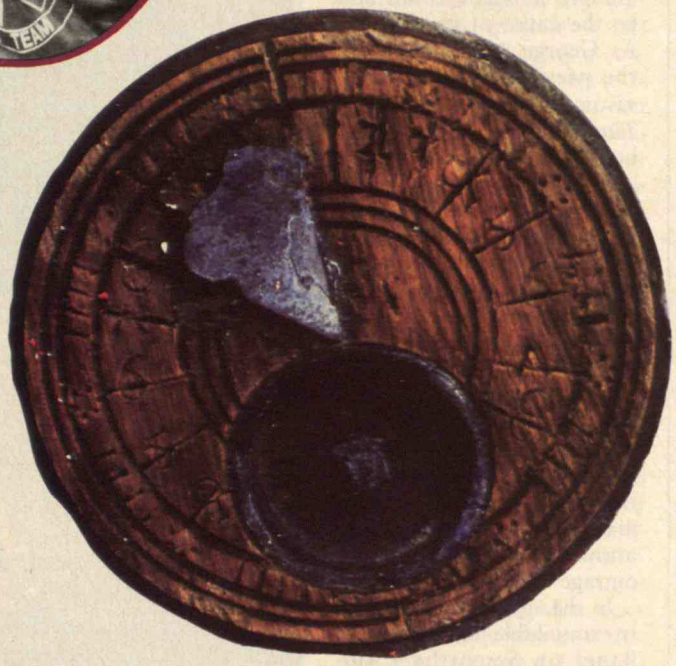
Alexander McKee has called the successful recovery of the *Mary Rose* "a boyhood dream come true." And in our role as "technical orchestrators" of the discovery, John Mills and I have shared in an exciting chapter in the ship's rich history.

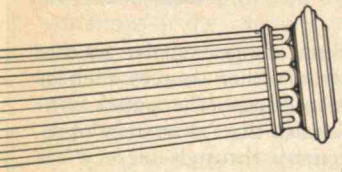
HAROLD E. EDGERTON, Institute Professor Emeritus of Electrical Engineering and Computer Science, has been at M.I.T since 1926. He is widely known for his invention of the strobe lamp and other high-speed photographic techniques—and more recently for the sonar techniques described in this article.









**Picture of Tudor life. Bronze cannon from the *Mary Rose* sterncastle is at left. Barber-surgeon's tools are at right, including a bleeding bowl, medicine bottles, and wood mallet probably used during amputations. Middle right: a pocket sundial (enlarged here), the early seaman's timepiece. Top right: this shawm, forerunner of the oboe, is a rare find. Prince Charles, president of the Mary Rose Trust, made many dives to the wreck. Divers faced poor visibility as they surveyed and excavated.**

# Two Cheers for Openness

Officials in the Reagan administration, notably the Departments of Defense, Commerce, and State, have been concerned that the system of open research, which is largely responsible for U.S. military strength, could also be the cause of its slippage. As George A. Keyworth II, the president's science advisor, told the *New York Times* last February: "Nobody is talking about putting a wrench on the nut of academic freedom. But there is a real hemorrhage of technology flowing to the Soviet Union."

Thus, a new governmental emphasis on secrecy—in the form of "export controls"—has pervaded international commerce, professional symposia and journals, university laboratories, and even classrooms. Not surprisingly, many in the research community have reacted with outrage and opposition.

In the spirit of heading off irreconcilable differences, a Panel on Scientific Communication and National Security—a distingished group chaired by Dale R. Corson, president emeritus of Cornell University—was formed last March by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The panel's mandate was to examine the costs and benefits of this new federal policy, as well as alternatives, and "to suggest how to balance competing national objectives to best serve the general welfare." The final report was issued at the end of September. Its conclusion, "that the vast majority of university research, whether basic or applied, should be subject to no limitations on access or communications," seemed to hearten researchers while provoking little discernible criticism from Washington.

Ever since the Reagan administration began attempting to plug alleged technological leaks, scientists have been warning that the best researchers would respond by boycotting the affected fields, thus reducing the rate of innovation. High-quality work, ever dependent on diverse channels of communication, would wither. "Our own military power will be diminished," said William D. Carey, executive officer of the American Association for the Advancement of Science, "if the wellheads of scientific communication are sealed and new knowledge confined in silos of secrecy and prior restraint."

Observing that leakage of information from the research community has posed little danger relative to that from other sources such as espionage, the panel concluded that "a strategy of security through secrecy" is undesirable and impractical. Instead, it recommended open communication—"a strategy of security through accomplishment."

But the panel did qualify its stand: laboratories on or off campus might someday become a source of information that the Soviets could better exploit. So the panel recommended a few fetters. It ar-

gued that "in rare cases," university research should be classified for reasons of national interest, and "in a few specific cases, limited control measures short of outright classification may be warranted."

This category, which the panel labeled "the gray area," was exemplified by work on very large-scale integrated circuits (VLSI). In this field, the panel alleged, campus research merges directly into technology with possible military applications. Therefore it suggested that nationals of designated foreign countries be prohibited from participating in gray-area research, and that it would be "not inappropriate" for universities to report foreign nationals who showed more than casual interest. Moreover, the panel proposed that scientific manuscripts based on such research be submitted to the federal sponsor for review at the time they were sent to a publisher. Technically, the right to publish would remain with the researcher, but the government would have the "ultimate power" to classify the research—thereby limiting the audience to those with the necessary security clearances.

Under these proposed restrictions—"the capitulation of the academics," as *BusinessWeek* put it—the panel was concerned with the unintended transfer of "know-how": skills gained through long-term, hands-on apprenticeship in a scientific or technical area. The panel maintained that "it is at times as important to safeguard technical know-how in areas of rapid advance [such as VLSI] as it is to protect military systems themselves."

Ironically, many educators consider such fields the most important of all for technical training. VLSI systems will soon form the basis for the electrical-engineering and computer-science curriculum, according to Paul Gray, president of M.I.T. "If universities are constrained from doing research in that area because of restrictions associated with export control," he says, "then inevitably the quality of our education will suffer."

"Restricting the free flow of information among scientists and engineers would alter fundamentally the system that produced the scientific and technological lead that the government is now trying to protect," observed Gray and the presidents of CalTech, Stanford, Cornell, and the University of California in a 1981 letter to the secretaries of defense, commerce, and state. "The best way to protect that lead," they asserted, "is to make sure that the country's best talent is encouraged to work in the relevant areas, not to try to build a wall around past discoveries."—*S.J.M.* □

# Optics Papers Banned

Responding to President Reagan's call for tightened security procedures, the Defense Advanced Research Projects Agency (DARPA) imposed a hasty ban on an entire session of the Optical Society of America's annual meeting late last October. The session was to have covered propagating blue-green laser beams through turbulence, clouds, and water. This technology is critical in high-rate data communications with submerged submarines. DARPA nixed the presentation of three other papers relating to laser communications. And the DARPA crackdown was not nearly as drastic as the navy's move to cancel 127 papers relating to airborne reconnaissance at the meeting of the Society of Photo-Optical Instrumentation Engineers last August.

The reason for the move by the Department of Defense to suppress previously unclassified research is an Executive Order requiring detailed new security regulations by the end of 1982. The object is to stem the flow of military technology to the Soviet bloc.

The last-minute cancellations of technical papers have provoked concern in the scientific commnity. John Rhea, editor of *Optics News*, objected that scientists "can't function effectively in a climate that denies them the information they need to push back the frontiers of technology." William D. Carey, executive officer of the American Association for the Advancement of Science, characterized the suppression of optics papers as a "surprise strike," and warned that "prospects for open discussion of leading-edge unclassified work now dwell in a no-man's land of confusion and disarray."

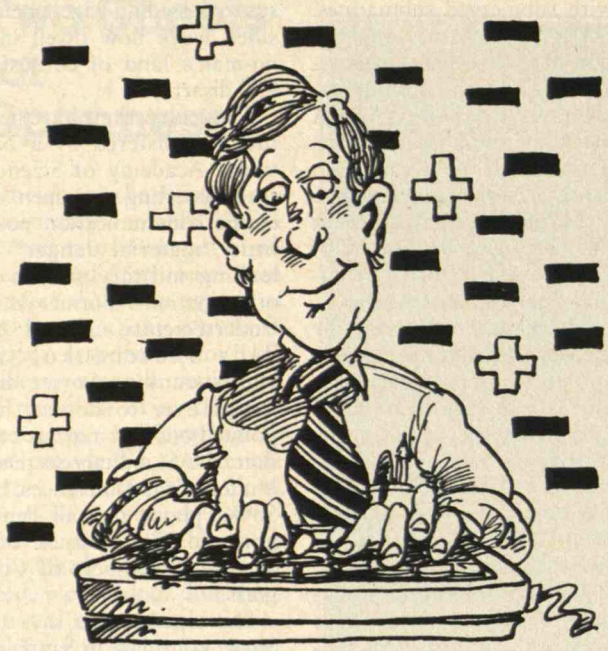
These objections have been further bolstered by a National Academy of Sciences study asserting that open scientific communication poses little "material danger" of leaking military secrets to other nations. Former U.N. Undersecretary General Arkady Shevchenko, the highest-ranking Soviet diplomat ever to defect, has pointed out that a major conduit of U.S. military secrets is not technical conferences, but Soviet phone taps of Pentagon and White House officials and members of Congress.

Shevchenko also says the Soviet consulate in San Francisco gleans technical information from phone calls from Silicon Valley firms developing sophisticated military microcomputers, integrated circuits, and fiber optics. Yet he says careless officials, legislators, and researchers ensure that this surveillance pays off: "Everybody is talking to anybody about everything."

The Soviets are also reputed to fly each issue of *Aviation Week & Space Technology* to Moscow for analysis. This magazine is widely known as "Aviation Leak," in recognition of its habit of headlining details of classified military technology. These tidbits are obtained from Pentagon brass, who feel the leaks enhance their favorite projects.

Given these lax conditions on Capitol Hill, at the Pentagon, and among defense contractors, it's not surprising that scientists feel unfairly singled out in the Reagan security crackdown.—*Carolyn Meinel* □

ILLUSTRATIONS: JON McINTOSH



# Negative Ions and Positive Vibes

Negative ion generators are curious little devices—their manufacturers' claims are inevitably followed by exclamation marks. "Is your air healthy?" asks one ad. "Recreate fresh mountain quality air indoors!" Negative ions, say manufacturers, make you feel alive, revitalized, and alert while relieving depression, headaches, and allergies. Trillions of these incredible negative ions somehow are supposed to kill bacteria and make plants grow better. But do such claims have any scientific basis?

Possibly. First, it is true that the number of "small ions" in the air—electrically charged molecules and atoms that are highly mobile—varies widely. Clean outdoor air may have 1,000 positive and 1,000 negative ions in each cubic centimeter, while polluted city air probably has fewer, and air-conditioned offices may have only 100.

Commercial ion generators can indeed change indoor ion levels drastically. When a high negative voltage is sent into a needle point, it generates both positive and negative ions. The negative ions are repelled by the negative needle (like electric charges repel) and blown into the room by a fan. The physics of ion measurements are almost certainly more complex than manufacturers and some experimenters recognize. However, an efficient ion generator may bring a room to even higher negative ion levels than typically found outdoors.

The question is whether increasing the number of negative ions makes people feel more comfortable and work more efficiently. The answer is especially important in regard to the video screens that display words and numbers at computer terminals. These screens, which many users say cause fatigue and headaches, usually have positive voltages strong enough to wipe out nearby negative ions.

L. H. Hawkins, from the Human Biology and Health Department of the University of Surrey in England, has performed two sets of experiments to find out how negative ions affect people. In the first set, Hawkins maintained high levels of negative ions in a room part of the time, but maintained predominately positive ions in the room the rest of the time. The people in the room, unaware that the ions were being manipulated, performed standard tasks.

When the ions were negative, the subjects did 25 percent better at complicated tasks such as drawing something while looking at its reverse image in a mirror. There was a smaller but statistically significant 6 percent improvement in simpler tests such as reaction time. Women seemed more sensitive to ions than men, and high humidity and temperature tended to wash out the benefit of negative ions.

In a second test, Hawkins installed two commercial ion generators in a congested computer office. The fans on these generators could be switched on separately from the ionizers, and with the fans always running, nobody in the office knew whether the ionizer was working. According to Hawkins' measurements, with the ionizer on, the office had about 3,500 negative and 100 positive ions per cubic centimeter of air; with it off there were about 550 negative and 500 positive ions.

At the end of their shifts, the 54 people in the office filled out questionnaires about how they felt and how they rated their environment. Negative ions did seem to produce positive effects. Workers complained of headaches in only 6 percent of the shifts when the ionizer was operating, but they complained in 26 percent of the shifts when it was off. The questionnaires revealed similar increases in how pleasant workers felt and decreases in complaints about nausea and dizziness.

Since some workers in computerized offices stay at terminals near video screens all day, where negative ions are so depleted, ionizers could be helpful accessories. But Hawkins emphasized that his findings are tentative. Negative ions are chemically reactive, so they could have some damaging effects. And other factors will undoubtedly prove far more important for workers, such as how satisfying the work itself is or what the boss is like.—*Nicholas A. Bond, Jr.* □

# The Medium is the Message II: Videotext

When federal Judge Harold H. Greene directed AT&T last August to keep out of electronic publishing for seven years—ruling that it may not write news to send over its telecommunications network—dozens of mass-media corporations were relieved. With AT&T's empire temporarily sidelined, they are more eager than ever before to cash in on videotext: electronic newspapers distributed over cables and microwaves to subscribers' video tubes. The would-be



ILLUSTRATIONS: JON McINTOSH





***Scoop*, a teletext magazine produced for high-school students. U.S. broadcasters expect that most stations will have teletext by 1985 and that most U.S. households will receive it by 1990, according to WGBH, the public broadcasting station in Boston. Would-be videotext publishers include Time and Dow Jones. (Photos: WGBH, Boston, and Antiope and Telematics Corp. of France.)**

videotext publishers range from local concerns to media giants such as Time, Inc., and Dow Jones.

To sell their latest information technology, publishers are developing a new new language and graphics. According to Helen Aller, director of the Electronic Text Center at the University of Florida at Gainesville, the nation's first school for electronic scribes, the language of videotext is a hybrid between that of broadcast journalists and that of newspaper reporters.

The letters are large enough to read from normal TV-viewing distance. Aller explains, "We get only 35 words per screen, and we never use more than two screens per story—unless it's an assassination of the president or something. Because everything is so short, you find yourself using a lot of colons. We don't think people want that much information. Most subscribers just want a headline idea of a story."

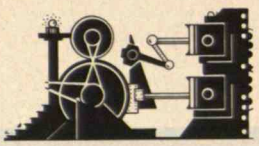
When writing videotext, explains Lynn McKnight, an editor at the center's Gainesville Cable Press, "You tend to suspend your ideas of style. You go for as short a word as possible, even though a longer word might be more understandable. Whenever you can, you use abbreviations, and you try to leave out titles. You wouldn't write 'President Reagan.' You just call him 'Reagan.' "

One of the ironies of the electronic information revolution, at least as envisioned at Gainesville, is that it has not brought subscribers more information—but less information more often. Although the Electronic Text Center produces news all day to be transmitted over Cox Cable Communication's channels 8 and 11, the school's "rotatext" system squeezes the news into a 15-minute format, to be repeated, with updates, ad infinitum. Once every hour, subscribers get a quick look at the 200 most active stocks.

Les Brown, editor-in-chief of the communications magazine *Channels,* finds the brevity of videotext stories "depressing." But he is quick to point out that television newscasters don't tell us much more. "You can get the message across in 30 seconds with advertising," he says. "But you can't do it with something like Reaganomics or the Middle East. You can't go to videotext for all the information. You can only get the top of the story and then you have to pick up *Time* magazine or the *New York Times*."

"I love the language as it is," Brown confesses—rather than in an abbreviated videotext version. "At its best print is a superior medium. But if you're ever stranded someplace where the newspapers are terrible, as I was recently, videotext will be welcome."

Jerome Aumente, chairman of the Department of Journalism and Mass Media at Rutgers University and au-



thor of a forthcoming book about electronic publishing, is not troubled by the current shortcomings of videotext. Videotext "is still in its formative stage," he says. He envisions the eventual creation of "a hybrid kind of shorthand" that merges color graphics with text, a visual medium where graphic arts are as important as language. Aumente is certain that as it matures, videotext will offer in-depth feature stories as well as the 70-word short takes now being produced in Gainesville.

But the real significance of the new electronic media lies beyond language and image and will come from the wealth of information available, says Aumente. When people get used to continuously updated news whenever they want it, they will be far less patient with intermittent television news—and perhaps also with lengthy newspapers.

The fast-food approach to marketing facts might produce a generation spoiled by easy access to information—or a glut of information that spoils rapidly.—*Art Jahnke* □

# Limbering Up Production

The philosophies and methods that made this country the world's most successful producer are now, according to social scientist Charles F. Sabel, contributing to our economic decline.

"Paradoxically, the United States is now having to pay the price of its early pioneering efforts," explains Sabel, an assistant professor in the Science, Technology and Society program at M.I.T. "Our dominant model—mass production—has frozen us into a difficult position."

Mass production, as popularized by Henry Ford, calls for specialized machinery and standardized products. The "smarter" and more dedicated the machines, the less skill is required of the workers, thereby lowering labor costs and increasing profits. The problem is that cookie-cutter production systems are easily copied—there's essentially no way to prevent competitors from buying similar machines and duplicating processes. And once markets are saturated with a particular mass-produced item, it's very difficult—sometimes impossible—to alter the bulky and costly machinery to make something new. Hence, American automakers continued to churn out big cars long after people stopped buying them.

Some major American companies have responded to this situation by cutting wages and personnel and bringing in robots and other automation. But this increases unemployment and lowers still further the level of skill and initiative required of those workers still on the job.

By contrast, the traditional European system is based on skilled workers' making products designed to meet specific needs. European markets are more regionalized than those in this country, and the workforce is less mobile. Therefore, industries tend to become associated with specific areas where highly trained craftspeople can innovate and collaborate on design. For example, in Italy some regions are known for their excellent shoes, others for their sporting goods, and still others for their salami-slicing equipment. Workers in each of these areas specialize and become experts in some aspect of the trade. The craftspeople, not the machines, determine the quality of the product.

"American tastes were homogenized by mass production," Sabel says. "We have learned to like, even come to expect, lower-quality products." But the more glutted markets become, the greater the demand for quality in the few products that are sold. Most American industries, Sabel says, cannot meet this demand. This helps explain why Americans increasingly buy imported cars, televisions, and stereo equipment.

The key to boosting the market for American-made goods, Sabel says, is to encourage flexible specialization—tailoring products to suit specific consumer needs. U.S. manufacturers should follow the example of the fashion industry, which anticipates and sometimes even dictates the desires of consumers and then quickly shifts to fulfill them.

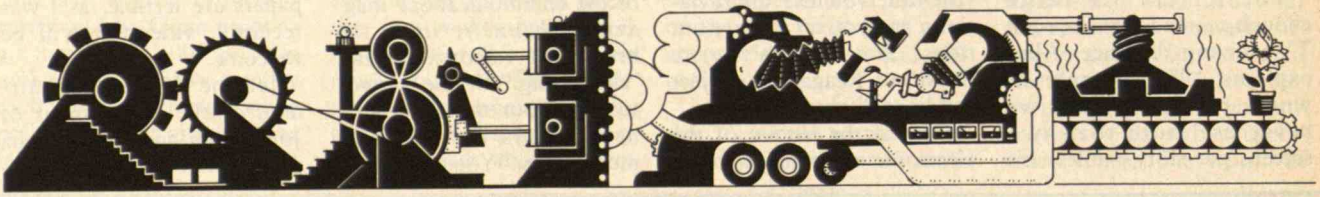
"When you've got a giant machine like the American economy, it's very hard to change," Sabel says, "but it is possible. We've got a trump card that we haven't yet played. In some areas, such as New England, there's a tradition of small farms, family businesses, and skilled craftspeople. By building on this tradition, the U.S. could turn things around."

Specialization has already taken hold in some sectors of the economy. The steel industry, for example, has seen an "explosion" of smaller mills that design and manufacture parts to customers' specifications. Other mills are producing alloys for specialized electrical and electronic applications.

"Technologically those mills are very progressive," Sabel says. They have broken away and are making products for disparate markets that large manufacturers are not flexible enough to serve.

Skilled labor is crucial to the success of flexible specialization. Workers must be versatile enough to adjust to the demands of a fickle marketplace—a quality that assembly lines discourage. Labor unions will have to help train employees. Most important, Sabel says, managers will have to take the time to look at the "big picture"—to educate both themselves and their employees to become more responsive to quixotic markets.

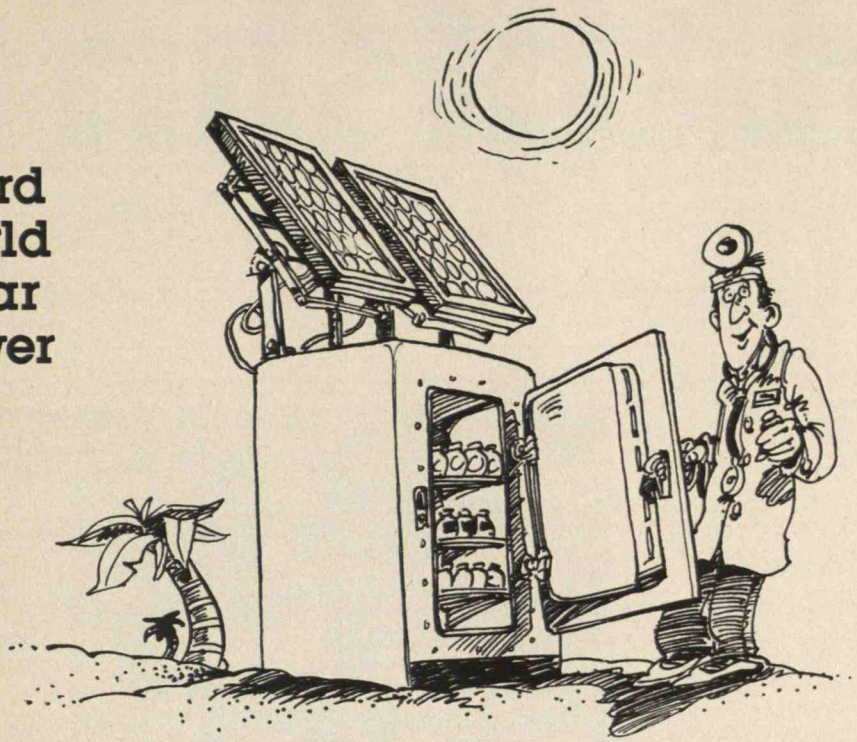
"Flexibility requires initiative, and requires it continuously," he says. "Our whole system needs to change" to accommodate that reality.—*E.R.S.* □





ILLUSTRATIONS: MICHAEL G. COBB; JON McINTOSH

# Third World Solar Power



By 1990 the United Nations' World Health Organization (WHO) intends to immunize every child against measles, polio, tuberculosis, diphtheria, whooping cough, and tetanus. These diseases kill over 5 million children each year, and despite the availability of vaccines, less than 20 percent of the 85 million Third World children born each year are being immunized.

Solar power may be the answer to WHO's chief problem in carrying out the scheme—lack of refrigeration. Vaccines are very sensitive to heat and must be maintained at temperatures between 39° and 46° fahrenheit; a degree too far in either direction can be critical. "All too frequently we first learn about a spoiled vaccine after a vaccinated child comes down with the disease," says David Bassett of the International Health Program of the U.S. Centers for Disease Control in Atlanta. "By then the medical team may have innoculated the entire village."

As a result many immunization programs have been confined to urban and suburban areas, where ready access to commercial power makes refrigeration dependable. But 80 percent of the world's population lives in remote areas without electricity.

In the absence of electrical power, many rural clinics now rely on Danish-made kerosene refrigerators that sell for about $800. Unfortunately, these do not provide reliable cooling in Third World countries.

The chief problem is that, with the rising price of oil, kerosene is becoming more expensive and hard to get. When funds run low or rains cut off supplies, clinics may find themselves out of fuel altogether. And by the time the fuel does reach the clinics, a 1980 WHO study showed, it is often watered down. The soot produced from the poor-quality fuel must be cleaned off almost daily for effective cooling. If somebody forgets to clean the soot off, the refrigerator may fail to maintain the right temperature and the vaccines may spoil. The refrigerator itself may also be damaged.

A photovoltaic solar refrigerator could solve these problems. The NASA Lewis Research Center, which develops solar systems for space, has worked with the Centers for Disease Control to draw up specifications for such a photovoltaic refrigerator. NASA has awarded contracts to produce prototypes to two companies—the Solar Power Corp. of Woburn, Mass., an affiliate of Exxon, and Solavolt International in Phoenix, Ariz., a division of Motorola. According to Lawrence Thaler, a solar engineer at NASA, field trials have begun in four rural clinics in India, Indonesia, and the Maldive Islands; by 1983 photovoltaic refrigerators will be undergoing tests in about 20 more Third World countries.

The prototype systems include an array of solar cells, a refrigerator, storage batteries, and the necessary controls. Placed on a nearby roof, the solar cells can supply electricity directly or charge the batteries, which have enough capacity to keep the refrigerator running for eight overcast days. The refrigerator cabinet is insulated with six inches of polyurethane and can keep the vaccines within the right temperature range even in 109° heat and 90 percent humidity. A small freezer can make about four pounds of ice a day for cooling vaccines on the long treks to outlying regions.

Manufacturers claim that with periodic defrosting, a photovoltaic refrigerator will provide at least ten years of reliable cooling. However, the batteries are guaranteed for only five years and are being replaced at an even faster rate. Manufacturers say they are being stolen in remote areas where car batteries are scarce.

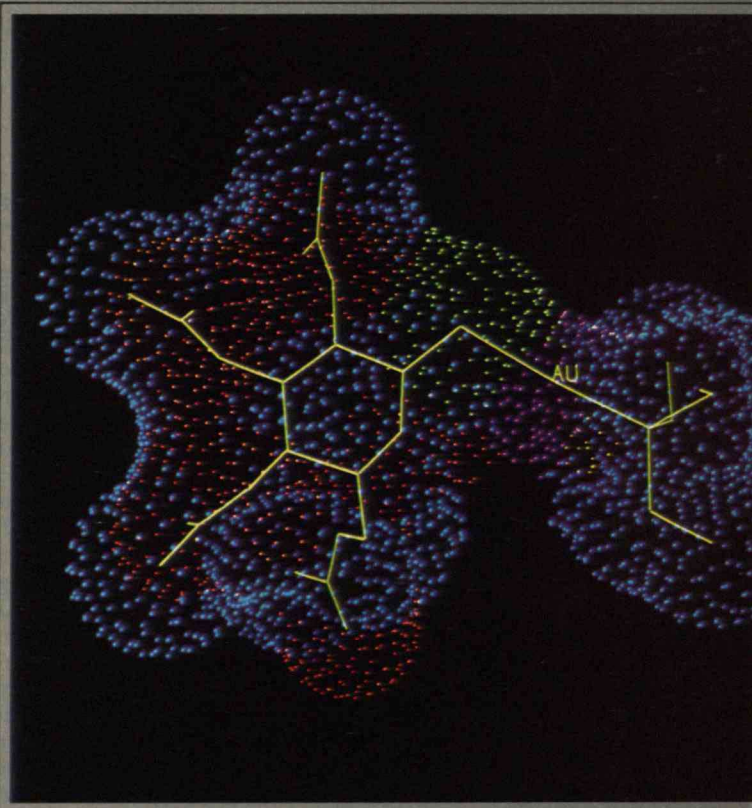
The sophistication of the photovoltaic system is a disadvantage in developing countries. The prospects for local manufacture are limited, and a photovoltaic refrigerator imported from the United States now costs about $6,000. The price may drop to $3,000, though probably not much lower, according to market analyst Brian Kennedy at Solarex in Rockville, Md. But Kennedy argues that the fuel savings alone mean that the capital cost of a photovoltaic refrigerator will be paid back in a little over four years. Besides, he points out, a kerosene refrigerator in the field rarely survives for more than five years.

Bassett at the Centers for Disease Control is wary. "Our interest is having the solar alternative assessed," he emphasizes. "Right now we don't know how good it is or whether it's economically justifiable for countries with limited resources. When the data are in, the facts will speak for themselves."—*Terry Lerner* □

*(Trends continued on p. 80)*

# SmithKline

SmithKline Beckman Corporation/World Headquarters




Before SmithKline united with Beckman Instruments to become SmithKline Beckman Corporation, those two world leaders in technology had made independent advances for diagnosis and treatment of rheumatoid arthritis. We now continue our complementary efforts.

**Immunology and Therapeutics.** The SmithKline research program that yielded our promising oral gold agent now under investigation (above, a computer model of the auranofin molecule) has been extended to study on the molecular level how the body's immune system operates and how changes in immunity may affect autoimmune diseases and alter susceptibility to infection.

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cellular and molecular biology, we are also investigating new aspects of gene regulation and function to develop new therapeutic agents targeted to key cellular macromolecules.

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Look into SmithKline Beckman. And look into the future.

## Technologies

# Space Weapons: The Whole World Is Watching

Most delegates knew that the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (Unispace 82), held in Vienna last August 9 through 21, would be political, as major U.N. events tend to be. But for some reason the 35-member U.S. delegation, led by James Beggs, administrator of NASA, assumed that only technical and scientific issues would be discussed. One issue the United States especially wished to avoid was the militarization of space, or more precisely, the introduction of weapons into space. In fact, the U.S. delegation held meetings before the conference with delegates of most major nations to express that wish.

But in their opening speeches, both the prime minister of Austria and the secretary general of the U.N. charged the delegates to address the militarization issue, labeling it the most important question facing them.

In the ensuing discussions, only the U.S. delegates argued that the question was beyond the purview of the conference. First, they said that military issues fall under the U.N. Committee on Disarmament in Geneva. Second, they maintained, space has already been militarized, and discussions may only make it more difficult for both the United States and the Soviet Union to use reconnaissance satellites to preserve peace.

Delegates from the 110 other nations at Unispace 82 saw no reason to avoid discussing the militarization of space, especially because the Geneva Committee on Disarmament had ignored it. They felt that explicit recommendations from Unispace could produce some action. The second part of the U.S. position was treated as a semantic ploy: the problem was not reconnaissance satellites but the introduction of arms into space—immediately, in the form of weapons to destroy satellites and interrupt communications, and later, in the form of weapons that emit lasers and particle beams.

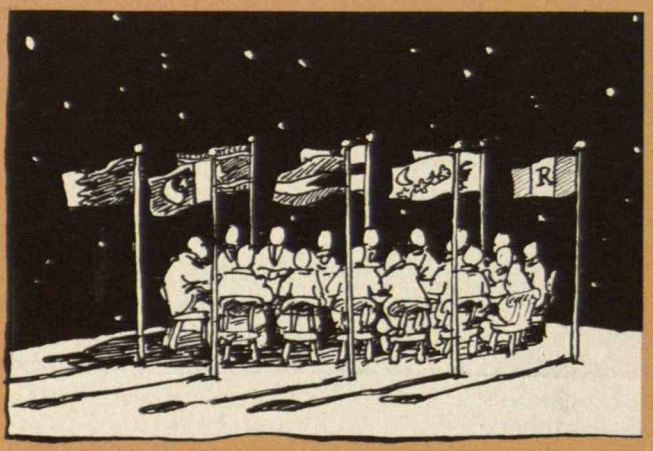
The U.N. Committee on the Peaceful Uses of Outer Space, under whose aegis Unispace fell, holds to a unanimity rule, so the U.S. delegation was able to prevent discussion of weapons in space. This only made it appear to delegates of other countries that the United States is bound on a course of militarization. Meanwhile, the Soviet Union—the only nation that has actually tested weapons in space—wisely remained silent.

U.S. delegates finally accepted a resolution stating grave concern about militarizing space. If passed at the beginning of the conference, such a resolution might have allowed for a much more useful discussion of many other issues on the agenda. Instead, the tactics of U.S. delegates ensured that the very issue they wished to avoid dominated the conference.

The carefully nurtured U.S. initiative—a cooperative ten-year study of the world's environment—was met with polite silence. U.S. delegates also maintained that technological improvements rather than political negotiations would resolve the crowding in the geostationary orbit (where communication satellites are able to remain above fixed points on the Earth). But most of the other delegates responded antagonistically to their suggestion. Resolving this important issue in the peaceful use of space remains for forthcoming conferences.

— *David C. Webb* □

## Final Unispace '82 Text on the Military Uses of Space

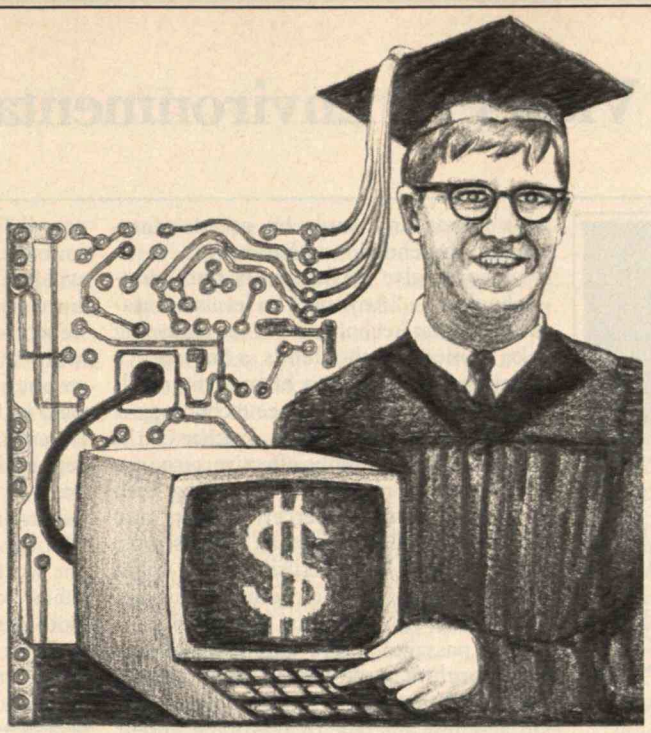


**1. The extension of an arms race into outer space is a matter of grave concern to the international community. It is detrimental to humanity as a whole and therefore should be prevented. All nations, in particular those with major space capabilities, are urged to contribute actively to the goal of preventing an arms race in outer space and to refrain from any action contrary to that aim.**

**2. The maintenance of peace and security in outer space is of great importance for international peace and security. The prevention of an arms race and hostilities in outer space is an essential condition for the promotion and continuation of international cooperation in the exploration and use of outer space for peaceful purposes. In this regard the conference urges all states to adhere to the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, and strictly to observe its letter and spirit.**

**3. The conference strongly recommends that the competent organs of the United Nations, in particular the General Assembly and also the Committee on Disarmament, when dealing with measures aimed at prevention of an arms race in outer space, in particular those mentioned in the relevant resolutions of the General Assembly, give appropriate attention and high priority to the grave concern expressed above.** □

# High Stakes in Lifelong Education



Future U.S. prosperity will depend on successful exploitation of the "information revolution"—the technologies of communications, computing, and automation as they can be linked together to provide powerful forces for more efficient management and more productive manufacturing. Unfortunately, not only are young engineers to lead the information revolution scarce, especially in electrical engineering, computer science, and communications. Worse, after five years these engineers find that the technology has moved out from under them—suddenly they're obsolete. U.S. leadership in information-based technologies is in jeopardy largely because we cannot keep engineers up to date.

This problem motivated M.I.T.'s Department of Electrical Engineering and Computer Science to mark its one-hundredth anniversary last fall with a revolutionary proposal, at least for M.I.T.: to provide lifelong education through university-industry cooperation. "Education must be extended to encompass most of the professional life of engineers," said a centennial report, "and responsibility for this new pattern of engineering education must be shared between academia and industry."

For its vision of "lifelong cooperative education," the M.I.T. proposal draws heavily on Stanford University's successful program of tutored video instruction (TVI). In this program, videotapes made in Stanford engineering classes are sent to cooperating companies, where employees assemble to watch. In each case a tutor works with the class, stopping the videotape when there are questions and relaying to Stanford problems the class cannot resolve.

The program has been a great success: thousands of students throughout the United States have received academic credit, and some have received Stanford degrees. John A. Young, president of Hewlett-Packard Co., the pioneer TVI partner with Stanford, says it's "the only case I know of where a top-flight university has been able to increase its productivity without in any way degrading the quality of its educational program."

The M.I.T. committee, chaired by Professor Robert M. Fano, gives only modest emphasis to postgraduate degrees. As far as M.I.T. is concerned, said the study, no TVI student should receive such a degree without spending at least one semester on campus. And each student would write a seminar paper—a "critical review of the literature" on a specialized engineering topic—and defend it just as on-campus students do with theses based on research.

Even with these nods to academic tradition, TVI would represent quite a compromise of the residence and thesis requirements of most first-class graduate schools, including M.I.T.'s. But the problem transcends such niceties. "Engineering education must be restructured," the committee writes. "The future vitality and competitiveness of U.S. high-technology industry depend on widespread acceptance of lifelong formal educational activities . . . in engineering work."

Raymond S. Stata, president of Analog Devices, Inc., who has been outspoken about high technology's "manpower crunch" (*see "High Technology, Higher Education, and High Anxiety," October, page 48*), is already an advocate. "The industry needs not just a few but a significant number of knowledgeable and intellectually sophisticated engineers," he said. The reaction from John Blair, corporate director of research at Raytheon, was the same but simpler: "How fast can you get [the program] started?"

Gerald L. Wilson, dean of M.I.T.'s Engineering School, carried the message to New York, proposing to a seminar on technology and education that the United States as a whole, and industry in particular, are too little concerned about the educational implications of the information revolution. An example of this indifference: M.I.T.'s program for engineers in industry to return to the campus for a year of "retooling" attracts few U.S. candidates while the Japanese claim every empty slot. "They are beating a path to our door and flying our technology out right over your heads," Dean Wilson told his audience of executives.

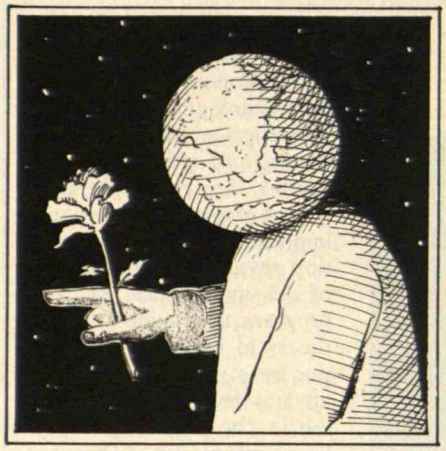
A strong dissent came from Joseph G. Gavin, Jr., president of the Grumman Corp. "We have plenty of creative talent, more ideas than we know what to do with," he declared. "We can take on any competition and beat them, and we do—including the Japanese." Grumman's problem, Mr. Gavin said, is not with ideas themselves but with how to put them to work. He needs more management and marketing expertise, and lots of Grumman people go back to school to get it all the time.

Ditto, said Carl N. Graf, president of W.R. Grace and Co. Students come from Japan, he said, because "the ideas are here, and we should be proud of that" instead of "psyching ourselves into loosing a battle we can win."

But let there be no doubt: many in U.S. industry and academia are concerned, along with Dean Wilson, about "our failure to compete in the high-technology market." The future of the United States depends largely on teaching engineers the new tools of the information revolution.—*J.M.* □

ILLUSTRATIONS: JON McINTOSH; TOM HIBSCHMAN

# Two Views of Environmentalism



## Personal Apocalypse

*The Eighth Night of Creation: Life at the Edge of Human History*
by Jerome Deshusses
Dial Press, 1982, $19.95

**Reviewed by Rosalind Williams**

After glancing at the barrage of undocumented statistics, horror tales, and highly debatable interpretations in the first major chapter, some American readers will heave this book into the corner, convinced that Jerome Deshusses, a French-born Swiss intellectual, is but another raving "environmental extremist." Others may welcome him as a sincere if overwrought ecologist. Both groups will be wrong.

The book soon veers off in the direction of its title—toward the edge of human history. Deshusses proceeds to demolish capitalist and socialist economics; love, marriage, and the family; and assorted other targets, reducing all he sees to the lowest common denominator of deceit and hypocrisy. Earnest readers who persevere through these tiresome denunciations are certainly aware that Deshusses is no conventional environmentalist. What is he, then?

Jerome Deshusses is first of all a *moraliste*, an untranslatable French term that refers to thinkers who view contemporary society in a historical, philosophical, and ethical context. He insists that the origins of the environmental crisis are primarily moral rather than technical or political. The pollution of our planet is the external manifestation of the poisoning of our minds and souls by greed, materialism, falsehood, and baseness.

Accordingly, Deshusses is not "anti-technology": "Anyone who levels accusations against (technology) . . . is reasoning like someone who lends a monkey a machine gun and then blames the result on the machine gun." Since technology is not the cause of pollution, neither can it be the cure. The only effective response can be moral revolution, beginning with oneself. Deshusses fiercely attacks any concept—be it the Freudian unconscious, political elites, or advertising—that might let people evade their ethical responsibilities as self-conscious individuals.

The passages where Deshusses speaks as a *moraliste* are by far the most valuable parts of the book. He bases his arguments on a significant type of reasoning absent from most American discussions of environmental issues. As befits a society proud of its pragmatism, we tend to be problem solvers looking for workable solutions that are either technological or political, or some combination. But Deshusses is not a problem solver or a world changer. He is a truth teller. And the painful truth, as he sees it, is that many aspects of the environmental crisis are rooted in consumer demands, in the unsatiable desire for more and better, in greed and inertia. All this may be cynically encouraged by advertising and manipulated by the privileged, but we cannot expect any change to come voluntarily from *them*—it has to be initiated by *us*.

Unfortunately, Deshusses' insights as a *moraliste* are swamped by his ideology as a conservative revolutionary. Like those early twentieth-century thinkers, many of whom drew upon the work of Nietzsche, Deshusses despairs of modern society and calls for revolt against the whole sorry mess to usher in an era of upheaval and rebirth. Most conservative revolutionaries think of the cleansing apocalypse in political terms, although they are too uninterested in politics to be conventional revolutionaries themselves.

Deshusses deviates by defining the coming upheaval in ecological rather than political terms. Not oppressed people but Nature will rebel, and this impersonal revolt will be the most efficient and ruthless of all: "[Chemicals] . . . want nothing, will not negotiate, will not wait, and will not argue." Deshusses welcomes the coming epoch of "ecological violence" as the "greatest turning point in human history." The deceit, contingency, messiness, and vile ugliness of everyday human life will be finally swept away, so the eternity, honesty, finality, order, and austere beauty of abstract life can emerge: "The word 'Apocalypse' does not mean 'catastrophe,' even though catastrophes encompass it. It means 'revelation.' "

James Watt, secretary of the interior, is reported to have remarked that we don't have to worry too much about using up natural resources since the second coming of Christ is nigh. His beliefs about how the world will end are based on religion, while Deshusses' are based on philosophy. Both are derived from mystic faith, and both are highly dangerous. They encourage us to let things grow worse, in the conviction that a supernatural apocalypse will save humanity from the consequences of its own carelessness.

In the end, Deshusses appears profoundly confused. With one voice he calls us to moral responsibility, yet in another voice he says we can abdicate responsibility because the ecological apocalypse is inevitable.

The basic contradiction is that while Deshusses insists that people are morally responsible for events, he deems nine-tenths of humankind incapable of assuming any such responsibility. The *moraliste* nudges the conscience of others by examining his own, and assumes a basis of common humanity. The conservative revolutionary's world is split between a few bold, truth-telling individuals like himself and the detestable collectivity called The People, The Humble, The Crowd. Distanced from the anonymous masses through anxiety and pride, Deshusses sees them as "monkeys with guns" who must be dealt with through coercion: "Collectively we have no soul, and that which has no soul learns only by force." Indeed, he implies that the elimination of humanity might not be such a loss: "Our nonsense is a blemish on the pure, noble universe of the galaxies and the mysterious grandeur of the animal world."

But Deshusses' views are not as troubling as the deferential reception his book has enjoyed in Europe. It was reviewed respectfully in the Parisian newspaper *Le Monde* and the racist *Parisien libéré*. Indeed, Deshusses may find his most appreciative European audience among the "New Right," especially the cerebral French wing that is generally antidemocratic, antiegalitarian, and authoritarian.

Because Deshusses scorns business, religion, and the family, he is not likely to find a receptive audience among the American New Right—nor among American leftists, who will be offended by his elitism. However, apocalyptic souls of almost any political persuasion could extract pieces of *The Eighth Night of Creation* to argue their cases. This is a disquieting thought. By welcoming "ecological violence" and scorning most of humankind as hopelessly corrupt, this book encourages both social injustice and environmental damage.

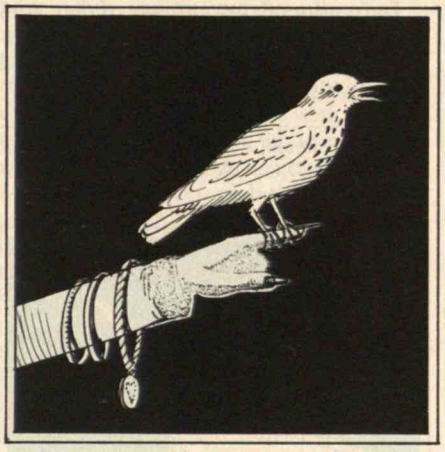
Deshusses would be the first to dissociate himself from the vulgarities of the *Parisien libéré* and remain aloof from politics. The first generation of conservative revolutionaries made similar claims, but this did not stop the Nazis from using their works to justify inhumane policies. Writers cannot be held responsible for their readers, but neither can they evade entirely the practical effect of their message: "by their fruits shall ye know them." If Deshusses insists on total, uncompromising accountability, why shouldn't we? □

*Rosalind Williams, an historian, was a research fellow in the Program in Science, Technology, and Society at M.I.T. from 1981-82. She is author of* Dream Worlds: Mass Consumption in Late Nineteenth-Century France *(University of California Press, 1982).*

## Tirade Against Elitism

*Progress and Privilege: America in the Age of Environmentalism*
by William Tucker
Anchor Press/Doubleday, 1982, 314 pp.

**Reviewed by Deborah Baldwin**



Environmentalists, claims William Tucker, are mainly upper-class reactionaries who are fearful of change and loathe technology. "Surfeited with affluence," they live in suburban enclaves, protected from want and ignorant of the benefits that technological inventions bring to the poor. So, through such "religiously" charged campaigns as those waged against agribusiness, nuclear power, and recombinant DNA, environmentalists have managed to protect the status quo while repressing the lower class. Along the way, they have built walls around otherwise useful wilderness areas, blocked the development of valuable mineral and oil deposits, and resisted the use of important chemicals such as DDT. If they'd thought of it soon enough, one gathers, environmentalists would have stopped humans from discovering fire.

Not everything done in the name of environmental quality, Tucker concedes, has been wrong. He notes that there are probably endangered species worth saving and parks worth preserving and waste dumps that ought to be cleaned up.

And here's where his argument—and his book—break down.

Not only, as *Progress and Privilege* unwittingly proves, is it impossible to generalize about a cause as large and diversified as environmentalism, but it's hard to generalize about its impact. In retrospect, environmentalists were right to raise questions about the Hooker Chemical Co.'s waste dump at Love Canal. They were correct in challenging the rosy predictions about nuclear power ("reactors as small as typewriters!" . . . "totally safe and clean" . . . "electricity too cheap to meter!") foisted on the public by industry and government during the 1950s.

But were environmentalists stopping progress when they blocked construction of four-lane highways in downtown neighborhoods? Were they barking up the wrong tree in the campaign to stop clear-cutting of woodlands? Is the Clean Water Act all wet? Does some cost-benefit formula somewhere come down on the side of stripmining? Should the law of the sea be deepsixed?

That depends. Cross-town, inner-city interstates are fine if you happen to use them to get to work. Clear-cutting and stripmining and river dumping are all useful practices if your company is so small it can't afford to do things differently. And using the oceans to mine for minerals and for dumping radioactive debris doesn't sound so bad if you don't eat seafood.

And so on. But whatever else may be said about environmentalists, it's hard to argue that they've protected the status quo. Environmentalism, like other activist movements, has done just the opposite. It has pushed for change: a change in the way businesses operate, the way politicians make decisions, and the way society treats such intangibles as clean air.

The biggest problem with *Progress and Privilege* is that Tucker has taken an ounce of provocative thought—the gist of which is that environmentalists have made mistakes—and stretched it so thin it snaps back in his face. That wouldn't have happened if his publisher had left *Progress and Privilege* where it belongs—in the pages of *Harper's* magazine.

*Harper's* bears responsibility for boosting Tucker from erstwhile newspaper reporter and self-declared drifter into the realms of book publishing. During the late 1970s, Tucker wrote a series of articles for the magazine debunking the environmental movement. Together with then-editor Lewis Lapham, Tucker claimed environmentalists were mostly wily lawyers and landowners with time on their hands and an uncanny ability to manipulate the nation's courts, legislatures, and media into mounting a reactionary campaign to protect the turf of the well-to-do—all while stomping on the aspirations of those beneath them.

The articles provoked a reaction partly because they were beautifully timed. Environmentalists were enjoying access to power during the Carter administration, making them vulnerable for counterattack. At the same time, formerly hard-line liberal publications such as *Harper's* and *The New Republic* were publishing sudden and unpredictable assaults on cherished liberal assumptions.

But several controversial magazine articles do not a book-long thesis make. *Progress and Privilege*, in short, is a tiresome tirade. At the close of each chapter, Tucker hastens back to his original point (that environmentalists favor the status quo and reject technology) to remind us

ILLUSTRATIONS: MARJORY WUNSCH

# When Big Projects Go Bust

that he hasn't lost sight of his theme. For example, he drags us through a painstaking description of how former-day environmentalists opposed the railroads (because they were dirty and noisy) and the invention of electricity (because it was dangerous), drawing an awkward analogy between these historical footnotes and today's quests to control pollution.

But Tucker can't keep saying environmentalists are the root of America's admittedly awesome economic problems and remain convincing. He lands in the unenviable position of arguing, for example, that the abolition movement was led not by those who rejected slavery on moral grounds but by reactionaries who feared industrialization, that technological side-effects such as pollution improve the process of evolution, and, perhaps most outlandishly, that "only nuclear war can radically change the world ecosystem."

To further prop up his argument's weak underpinnings, Tucker is relentlessly upbeat about the future. Concerned about the implications of recombinant DNA experiments? Think we'll never find a safe way to stash radioactive wastes? Wonder if swimming at Coney Island will ever get better again? Not to worry. Tucker is so busy defending industry he doesn't bother to delve into these troublesome areas. In fact, his style borders on corporate sloganeering: "scientific thought is an adventure"—that sort of thing.

Tucker's thesis is partly that progress involves give and take. He ignores the fact that in our society, that's what social movements are all about: they push and push for radical change and the system, under extreme pressure, relents a bit. Political and economic power doesn't change hands, but reforms are enacted and society benefits. Tucker seems to be saying that we should go back to the laissez-faire way of doing business, with corporations making decisions for all of us.

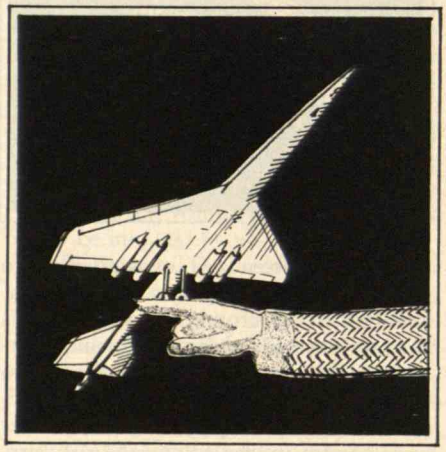
Indeed, the most unconvincing aspect of the book is the way Tucker lumps together technology, science, and industry and labels them as one positive force. Even more questionable is Tucker's belief that environmentalists represent a tiny minority. In poll after poll, the great majority of Americans favor clean air and water, even if it means paying more for goods and services.

Which brings us back to the problem of timing. For two years the nation's leaders have been not so much in favor of the status quo as in going back to the age of robber barons and unfettered growth. Environmentalists are no longer in power; Tucker's book just hits them while they're down.

Along the way Tucker overlooks some genuine weak points in a movement old enough and strong enough to withstand constructive criticism. Tucker misses an opportunity to point out how queasy many third-generation middle-class activists are on the subject of the profit motive. In rejecting entrepreneurship, many social activists may be overlooking one of America's most useful historical strains. Now that environmental values are entrenched, new goals pertaining to positive development—including economic reform—are indeed needed.

Tucker doesn't get into any of that. And he is saving his vision of a better environmental movement for an as yet unpublished second volume. □

*Deborah Baldwin, a free-lance writer based in Washington, D.C., is a contributing editor of* Environmental Action.



## Supersonic Skirmish

*Clipped Wings*
by Mel Horwitch
M.I.T. Press, 1982, 475 pp., $25

**Reviewed by Richard S. Tedlow**

It has been written that nothing is so susceptible to oblivion as an argument, however ingenious, that has been discredited by events. The same could be said of technological innovations: those seemingly discredited by events are relegated to the "dustbin of history." People say they failed because they *should* have failed.

It is tempting to place the American supersonic transport, or SST, program of the late sixties and early seventies in this category. After all, the British-French Concorde, the competition American SST supporters were always pointing to, has been proven to be more trouble than it was worth. And William Allen, Boeing's chairman while the SST was under consideration and one of its staunchest supporters, observed that the American program's demise "could well have been a good decision."

Looked at in broader perspective, however, the failure of the American SST program should not be so quickly dismissed. Allen also observed that the ultimate development of an American SST was "inevitable."

If, then, building an American SST was not an inherently bad idea, why did the SST program of the late 1960s and early 1970s not bear fruit? What, if anything, can analysts of major public-private projects, especially those that are technology intensive, learn from the episode? In *Clipped Wings*, his study of the fight over the American SST, Mel Horwitch has provided much rich material to help illuminate the answers to these questions.

An observer can discern two conflicting views of technology and change in the SST battle. The first might be called the "steamroller" model. This view was characterized by some physicists working on the Manhattan Project, to which the SST was compared in its early years. These physicists felt that if the atomic bomb *could* be invented it *had to be*, even if its inventors found it monstrous—it was an international competitive necessity. Time and again, as Horwitch shows, proponents of the SST viewed the project as unstoppable. Opponents were the same kind of people who opposed the steam engine, according to supporters, and their opposition in this instance would be no more effective.

When people believe a development is inevitable, they tend to ignore or downplay obstacles. The greater the obstacle, the more steadfast the denial of its importance. Thus, Horwitch reports, as early as 1959 a major feasibility study paid little attention to the problem of the sonic boom, despite the fact that the boom and the possible problems it might cause

were certainly no secret. In the long run, the boom proved to be an unsolved problem of flying at supersonic speeds, and it was ready-made for the program's opponents to exploit—sometimes in rather lurid fashion.

The second model of technology and change is the opposite of the steamroller—one we might call "stasis." In this view, big projects are apt to fail, especially in our society. Why does "nothing get done" here? Because there are so many interstices in America's political power grid into which opponents can insert themselves. Horwitch chronicles the remarkable effectiveness with which William Shurcliff organized and ran his Citizens League, waging an enormously effective publicity campaign against the American SST and the sonic boom. Having nothing to lose, he did not need to bargain or compromise—he was able to avoid equivocation while his opponents could not.

Which model best describes reality: steamroller or stasis? The answer is that there is no answer. Big projects—interstate highways, nuclear power plants, the SST—are so complex that their fate cannot be predicted. Such projects involve different levels of government, span different sets of years, and, at least as important, have different groups and individuals supporting and opposing them.

Nevertheless, two aspects of the big project can determine whether it will be successfully completed. The first is time horizon—how long the project will take from inauguration to completion. As the time required lengthens, so do obstacles. Costs escalate. Government bureaus and agencies grow and change. For example, the Federal Aviation Agency (FAA) was absorbed into the Department of Transportation in the midst of the SST struggle. Individuals supporting or opposing a project change jobs and interests. The shape of the chess board is constantly being altered.

A second aspect determining the outcome of major projects is public opinion. Big projects impinge on the general public in myriad ways. They may be unsightly. They may make noise. They always cost money. They may directly benefit only a small segment of society. When big projects demand choice and sacrifice, public opinion should play a major role in determining their success. But too often they stand or fall on the basis of the appearance rather than the reality of public support or opposition. What the public sees is various contesting parties brandishing clippings, polls, and studies like weapons. Under such conditions, decision makers do not have an accurate idea of whether the public regards a project as a boon or a boondoggle. Indeed, this exploitation of public opinion is a distressing subtheme of the SST conflict. The public was given slogans to hang their hats on, and the contesting parties tried to show that theirs was the slogan with the greatest acceptance.

### The Cloak and the Champion

Given this state of affairs, how can one judge whether proponents or opponents of a major project will be successful in winning this public support—whether steamroller or stasis will be the order of the day? The first consideration is whether the project can be cloaked with a cause that will promote strong emotional backing. The best modern examples are the Manhattan Project and the space program. These did not stand or fall on the basis of cost-benefit analyses, because national defense and pride were clearly involved.

In contrast, Najeeb Halaby, the head of the FAA from 1961 to 1965 and later head of Pan American Airways, tried to cloak the SST project with a spiritual aura that surrounded flight. Halaby later wrote that "flight *can* be a poetical, mystical, almost religious experience; for me, flight has always evoked the biblical Genesis, in which 'God gave man dominion over the earth and over every creeping thing upon the face of the earth.' " To Halaby, the SST was "a logical expression of faith in aviation's progress."

But unlike the cloaks for the space program and the Manhattan Project, Halaby's cloak did not go uncontested. Robert S. McNamara, who became the chairman of the President's Advisory Committee on Supersonic Transport in the spring of 1964, looked at things differently. For him, the SST was clearly a commercial proposition. He was utterly unimpressed by the spiritual dimensions of passenger flight. Nor was he moved by arguments about what the commercial air-transport industry could do for America's defense. "If the Russians could build 707s cheaper," he once declared, "I would buy them from Russia."

Because McNamara viewed the SST through the prism of sophisticated return-on-investment criteria, he demanded exhaustive economic studies, which tended to be negative. They took into account both the coming of the jumbo jets and the fact that route restrictions caused by the sonic boom problem would limit the market for the SST, resulting in a decrease in the total number of units manufactured and a rise in unit costs.

The fact was that when the numbers were pushed carefully they did not look good. The effort to cloak the project either in its own majesty or its potential contribution to national defense failed, and the numbers became the basis upon which the SST was evaluated. Thus, its economic shortcomings became a key to its demise.

A second consideration is that a major project, to be successful, needs a manager who knows how to contain it within feasible bounds, when to push it through, and when to compromise. Perhaps the most accomplished such leader in modern times has been Robert Moses. The Cross Bronx Expressway could not be cloaked with national defense, and its building demanded the disruption of thousands of lives. Yet there it stands today because of Robert Moses—an undeniably effective champion, think what one will of the morality of his methods.

A third factor, on which a project's fate can stand or fall, demands but also defies analysis. That factor is luck. On December 2, 1964, the FAA staged a demonstration for experts and the media at White Sands, N.M., designed to show that the sonic boom would not be an excessive problem. The visitors witnessed and heard a number of supersonic flights, all seemingly uneventful. But at the end of the program an F-104 made one last pass for the benefit of press photographers. The pilot came in at 200 feet and unintentionally accelerated to supersonic speeds. The result was a massive boom that cracked windows and plaster, rocked a trailer, and interfered with broadcasts. Many guests later complained of headaches. "The media now had something dramatic to report," observes Horwitch. "One of the SST's alleged major flaws had been indelibly implanted in the minds of a large group of reporters." □

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## SPACE/ROBERT COWEN

*(Continued from p. 6)*

Thus, Sputnik was an angel of rescue for beleaguered U.S. scientists. The alarm it aroused focused national attention on the state of science, and the great space science and general science buildup of the late 1950s and 1960s followed.

### A Science Hymn

Today U.S. space and general science is again in some disarray because of funding problems and a lack of coherent national policy. One wonders if another Sputnik is needed. Just as the Eisenhower administration ignored the Soviet buildup before Sputnik, so the Reagan administration appears to view the establishment of a permanent Soviet space station with indifference. If Sputnik had been a Salyut with two cosmonauts permanently in residence, the United States might really have panicked. As it is, the U.S. press and public seem scarcely to know *Salyut 7* exists.

Part of the concern in 1957 focused on the lack of good science education in secondary schools. Many scientists deplored the lack of qualified teachers and the indifference of pupils. Through much effort, scientists such as M.I.T.'s Jerrold Zacharias, working through projects such as those of the Physical Sciences Study Committee, brought a renaissance to high-school science teaching, with the National Science Foundation (NSF) funding major new curricula. Now, in the 1980s, the ground gained in the 1960s seems to have been lost. Scientists and their organizations again warn of a crisis in high-school science education, and Congress has discouraged NSF from developing new science curricula.

It is hard for one who lived through the Sputnik alarm not to believe that a new renaissance for U.S. science and education is in the offing. Again the need is urgent, and again there seems to be a growing national awareness of the problem, although the reaction lacks the intensity of that following Sputnik.

What is to be done? Although there are no easy answers, one approach does stand out. The lack of mechanisms for establishing long-term space (and science) policy, together with the long-term funding to sustain it, must be addressed. As OTA points out, this lack, more than any other factor, undercuts U.S. ability to maintain a consistently strong and fruitful space and general science effort. Addressing this problem, National Academy of Sciences President Frank Press has urged that an "entitlement" program for the sciences be established to provide basic support for a core national research effort despite the vagaries of the annual budget process.

The need for a sustained national space and science strategy has been preached for decades, but it now seems urgent. The country can no longer afford to respond to a sudden scientific challenge by pouring in vast new funds, as it did after the appearance of Sputnik. The United States must choose its priorities carefully to avoid such challenges and then give them a sustained funding. □

## LOYALTY/SAMUEL FLORMAN

*(Continued from p. 8)*

companies to go. And let the same process apply wherever technological progress impinges on other values that society holds dear—particularly public safety and environmental quality.

### Aligning Loyalties

When engineers are loyal to their own organizations, the system works and the public is served. But more is involved than efficiency. The quality of communal life depends upon the trust and respect that prevails among families, friends, and coworkers. An abstract devotion to "the good of humanity" is no substitute for devotion to real human beings. Out of fruitful personal relationships comes the decency that sets the moral tone for society.

Unfortunately, since the 1950s the concept of loyalty has been tarnished by too many loyalty oaths and abusive demands for conformism, just as the concept of patriotism has been sullied until the term has become almost pejorative. The problem is as old as humanity: how to balance the rights of the individual with the needs of the group. At this moment the pendulum has swung far in the direction of individual assertiveness. This is fine, except that it has happened at the expense of loyalty, a concept that needs to be nourished, particularly within technological organizations. National problems such as waning productivity and faltering innovation are undoubtedly related to this development.

If I were able to pick up again my discussion with the troubled young engineer, I would urge him to embark upon his career with great enthusiasm, and not to be overly apprehensive about his work's harming society. I would tell him to disregard those who exhort engineering students to become moral heroes by resisting the "spectacular corruption" they will encounter in industry.

Naturally he must follow his own star, but to a certain extent he has done this already by choosing to be an engineer, who must work with others, rather than, for example, an artist who can work alone. There are still personal decisions to be made. If he is averse to armaments or nuclear power, by all means let him steer clear of these fields. If he is an ardent environmentalist, let him seek work in that area. But once engaged in an engineering task, let him put his whole heart into it. He can maintain his values and sense of self without indulging his ego at every turn. If he wants to serve society, let him do good work.

What if, in spite of the enormous odds against it, he does encounter base practices and experiences a crisis of conscience? Loyalty to the group will require that he come down on the side of legality and prudence. No assemblage of engineeers is well served by deception. And if the very worst should happen—if he becomes involved in a situation that cannot be honorably resolved within his organization—then, I would rather rely upon the righteous wrath of an engineer whose loyalty has been betrayed than upon the pique of an engineer who was from the start a suspicious malcontent.

It is a bittersweet paradox that new-fangled technology, because it depends so much upon group effort, should summon forth old-fashioned morality. The American philosopher Josiah Royce, writing at the beginning of this century, spoke of the need for "loyalty to loyalty." It is regrettable that this idea is eclipsed in our time. □





*(Continued from p. 13)*

There is evidence of wide public interest on the broadcasting side, too. "Report on Science," a series of radio spots produced by CBS and the American Association for the Advancement of Science, first aired in March 1981 in eight major U.S. cities. By July 1982, the series had added eight more large North American markets and developed an audience of several million. And Don Herbert's "How About . . ." TV spots have been included in prime-time news broadcasts by more than 140 stations in markets representing more than 70 percent of U.S. homes.

But perhaps the most convincing evidence of broad public interest in science and technology is the scores of journalists' phone calls received month after month by SIPI's Media Resource Service. The calls come from reporters at newspapers, magazines, radio stations, and television stations, large and small, in major cities and backwater towns in all parts of the country. The questions concern every aspect of science, from energy and the environment to medical treatments and space projects. Significantly, many calls come from radio and TV talk-show hosts looking for scientists to appear as guests—a clear sign that science is continuing to "draw" in the ratings war.

Most (80 percent) of these reporters are preparing material to be included in general news and feature coverage. In fact, some observers argue that the trouble with the science media is that they are just that, *science* media; that as long as people consider science a special category, there will be a limited audience. But just as millions read the sports pages and watch the sports segment of the evening news who don't actually subscribe to *Sports Illustrated*, so the vast majority of Americans may be hungry for science as part of their media menu but not as the whole meal. This may present a packaging problem for media managers—suggesting a need for more science columns and brief "spots"—but it hardly bespeaks an inattentive public.

Of course, even if most people *are* inattentive to science, the question remains: Can their attention, their interest, even their understanding be developed? And is it worth the effort? Many, myself included, vote yes.

### Beyond Discovery

There is one neglected approach to increasing audience enthusiasm—more coverage of today's critical policy controversies involving science and technology. Eighteen months ago, in this magazine, I suggested that the science media were devoting too much space to gee-whiz journalism—to discoveries, inventions, and breakthroughs—while virtually ignoring important policy questions facing this country. (*See "The Great Science and Technology Bazaar," May/June 1981.*) With a few exceptions, this practice has continued.

Science in the mass media has remained primarily a sales contest in which the goal is to come up with the newest new-ness. Major policy issues—such as whether publishing uncensored scientific research papers gives the Russians valuable information—continue to be downplayed. Could it be that if the media magnates devoted significant prime time, front-page space, and cover color to the pro's and con's of nuclear aircraft carriers, or what to do about toxic chemical dumps, or how to upgrade science education, they might improve their own popularity as well as public understanding?

To be sure, the argument for more coverage of science-policy issues is not ultimately based on ad sales or circulation. It is based on the public's need to know. Increasingly, major policy decisions—military budget priorities, energy alternatives, hazardous-waste disposal options, cancer research programs—depend on understanding science and technology. Leaving such understanding to the "experts" or even the "attentive public" carries serious implications for the nation's decision-making process. Even if science policy doesn't improve the bottom line, it needs to be covered more widely—and especially more deeply. A public that understands the issues, including the views of responsible though differing scientific experts, is more likely to have confidence in and even enthusiastic support for political decisions.

Still, it is interesting to speculate on just how popular science-policy issues might be, given half a chance. Leon Jaroff, managing editor of *Discover*, reported that his May 1981 edition featuring the evolution-creationism controversy "drew by far the largest reader response of any issue we've published." That topic might well be an exception, of course, and others that don't involve religion might not fare so well. But isn't it worth a try?

This is not to argue against coverage of inventions and breakthroughs—only to stress that science involves more than what I call "phenomenology." Perhaps the declining fortunes of some science media efforts will encourage media decision makers to add a little meat to their future science menus.

It may just be that wonderment alone, even with Walter, is not enough. □

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# A carat or more.
# A little extra weight she won't mind putting on.

The 1.57 carat diamond ring shown below is enlarged for detail.

## An extraordinary diamond of a carat or more.

Every diamond is rare.
But a diamond of a carat or more is only one in a million.
And, like love, becomes more precious with time.

A miracle among miracles.
Born from the earth. Reborn on a woman.

The extraordinary diamond solitaire. When a man's achievement becomes a woman's good fortune.

A diamond is forever. De Beers


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